DOKUZ EYLÜL ÜNİVERSİTESİ MÜHENDİSLİK FAKÜLTESİ

ELEKTRİK - ELEKTRONİK MÜHENDİSLİĞİ BÖLÜMÜ

Bitirme Projeleri Sergisi, 2024

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BİTİRME PROJELERİ SERGİSİ
ÖZETLER KİTAPÇIĞI

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İZMİR

SUNUŞ

Fakültemiz bünyesinde bulunan 12 Bölümümüzden Öğretim faaliyetleri süren 11 Bölümümüzde mezuniyet aşamasına gelmiş mühendis adayı öğrencilerimizin hazırladıkları bitirme projelerinin poster sunumlarının sergilenmesi Fakültemizde geleneksel olarak her Bahar Dönemi sonunda gerçekleştirilmektedir.

Öğrencilerimizi, ülkemiz 12. Kalkınma Planı, Vizyon 2050 hedefleri gibi özellikle ülke öncelikli araştırma konularında, öğrenim aşamasında elde ettikleri bilgi ve becerileri kullanarak sorgulayan, araştıran, veri toplayan ve sonuçları bir proje çerçevesinde sunabilen mühendisler olarak yetiştirmenin gayreti ve mutluluğu içerisindeyiz. Bitirme projeleri hazırlayan öğrencilerimizin yaratıcılığına, yeteneklerinin geliştirilmesine katkıda bulunarak; ülkemizin geleceğini yönlendirecek, uluslararası bilimsel çalışmalarda özgün düşünceler ortaya koyabilecek, Ar-Ge ve innovasyonda etkin, özgüveni gelişmiş bireylerin yetiştirilmesi Fakültemizin ana hedeflerinden biridir.

Bölümlerimizde gerçekleştirilen bitirme projesi sergisi ile öğrencilerimiz projelerini öğrenci, öğretim üyesi ve üniversite dışındaki kurum ve kuruluş temsilcilerine de tanıtma fırsatı bulmakta ve kamu-üniversite-sanayi iş birliği sürecine de katkıda bulunmaktadır.

Bitirme Projesi sergisine katılan öğretim üyelerimize/elemanlarımıza, öğrencilerimize ve tüm kuruluş temsilcilerine katkıları için teşekkür eder, sevgi ve saygılarımı sunarım.

Prof. Dr. Azize AYOL

Dekan V.

Bitirme Projesi Sergisi

Düzenleme Kurulu Adına

ÖNSÖZ

Bölümümüz uluslararası düzeyde rekabet edebilen, bilgi birikimini ve deneyimlerini toplum yararına kullanabilen, mesleki ve evrensel etik değerleri konusunda duyarlı, Elektrik ve Elektronik Mühendisliğinin bütün dallarında donanımlı ve bu alanda ulusal ve uluslararası toplumun ihtiyaç duyduğu bilgi ve teknolojilerin araştırma ve geliştirme çalışmalarını yapabilen mühendisler yetiştirmeyi amaçlamaklamaktadır. Bu amaç doğrultusunda, bitirme projeleri öğrencilerimizin ilgi duydukları bilimsel alanlarda sorgulayan, özgün fikirler ortaya koyabilen, problemlere çözüm üretebilen bireyler haline gelmelerini desteklemektedir.

Proje sergisi etkinliği ile öğrencilerimiz iki dönem boyunca araştırdıkları, geliştirdikleri projelerini sunma fırsatı bulunmaktadır. Etkinlik üniversite-sanayi işbirliğine katkı sunmakta ve öğrencilerimiz firmalarla tanışma fırsatı bulmaktadır.

Bitirme Projesi sergisine katılan herkese teşekkür eder, saygı ve sevgilerimi sunarım.

Prof. Dr. E. Yeşim ZORAL

Elektrik-Elektronik Mühendisliği Bölüm Başkanlığı

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Bitirme Projeleri Sergisi, 2024

1 MACHINE LEARNING FOR DETERMINATION OF PERSONALIZED IMAGE QUALITY METRICES

Tunahan Keskin

Danışman: Prof. Dr. Alper Selver

ÖZET

In the research project, segmentation algorithms were applied to computed tomography datasets and edited. In these edits, the segmentation results were adjusted so that they could be observed in both 2D and 3D. Finally, these segmentation results were sent to experts for scoring. While waiting for segmentation scores from experts, data preparation for machine learning started. 9 different image quality metrics were applied to the segmentation results. Python application was used to prepare the codes of these metrics. These 9 metric values were recorded for each of the 1900 segmentation results. The metric values were normalized. The inputs of the data needed for machine learning were prepared. Then, the scores from the experts were used as output. Thus, the data required for machine learning was prepared. Since the output values of the data are known, supervised machine learning classes were used. The machine learning problem in the project was regression since both the input and output values were numerical. 10 different machine learning models were used. These were Multilayer Perceptron, Linear Regression, Lasso Regression, Bayesian Ridge Regression, SVR Linear, SVR RBF, SVR Poly, Gradient Boosting, Random Forest, and Elastic Net models. Parameter settings of these models were adjusted. Mean squared error metric was used to determine the error values. The model with the least error was selected. In the last part, 2 different techniques were used to determine the ranking of image quality metrics from the selected model results. These are permutation importance and SHAP techniques. In addition, as a different approach, constrained optimization

technique was used to determine the importance of the metrics directly from the data. Thus, the image quality metrics that are important for each expert were determined. If the segmentations are prepared by considering these image quality metrics created for the experts, time can be saved, and more accurate medical diagnoses can be made.

2 DESIGN AND IMPLEMENTATION OF MIL-STD COMMUNICATION PROTOCOL

Hasan Korkmaz, Ramazan Faruk Çelikel, Hatice Beyza Arıcı, Mehmet Salih Yavuz, Sedat Baş

Danışman: Asist.Prof.Dr. Damla Kuntalp

ÖZET

The MIL-STD-1553 Communication Protocol has been continuously developed and utilized since the 1970s, playing a critical role in military and aviation applications. Therefore, it is essential to develop and improve this technology. This project requires a competent team that combines various disciplines such as telecommunications, control systems, embedded software development, hardware design, and many more. Our team is here to re-evaluate the MIL-STD-1553 Communication Protocol, conducting analysis, design, implementation, and reporting processes to meet the current and critical communication needs in military and aviation fields and establish a robust presence in this domain. As the HBR2S team, throughout this period, we have endeavored to design and implement the MIL-STD-1553 Communication Protocol as accurately as possible within our budget, utilizing our available financial resources and the technical and theoretical support we could obtain. Throughout this process, we, as the HBR2S team, managed to overcome the obstacles and challenges we encountered, thanks to our determination, patience and hard work, as well as the valuable assistance of our consultants. As a team, we are very proud of this success we have achieved as a result of our joint efforts and cooperation.

3 3-DIMENSIONAL VISUALIZATION OF THE USER'S HAND AND FINGER MOVEMENTS USING GLOVES WITH BENDABLE E-TEXTILE MATERIAL

Ömer Can Kaçınurkan

Danışman: Assist. Prof. Dr. Damla Kuntalp

ÖZET

Flex sensors are used in many fields nowadays such as automotive, robotics, wearable devices, biomedical devices. The demand for wearable technology products using these sensors has been increasing recently. This project is about designing one of these products by using flex sensors, called e-textile product. Flex sensors will be placed on a specially produced glove to monitor the bending movements of the hand and at the same time the rotational movements of the hand will be detected with the IMU module. These data from the sensors will be transferred to the computer via a wireless serial port. Again, with the help of the program to be used, the hand movements will be displayed on the computer screen simultaneously. This image transferred to the computer can then be used to transform the rehabilitation process of people who have lost their hand functions for various reasons from a boring and longtime process to a process that will make it enjoyable and easier. In addition, the communication process of disabled people can be facilitated and activated by assigning commands to finger movements.

4 CLASSIFICATION OF LUNG SOUNDS

Doruk Kaynak

Danışman: Assist. Prof. Dr. Damla Kuntalp

ÖZET

Lung diseases are one of the major causes of death and poor quality of life worldwide. In 2019, the World Health Organization (WHO) reported that respiratory diseases are the second leading cause of death [1]. It is necessary to diagnose and treat respiratory disease patients. So, it is decisive to diagnose respiratory system diseases at early stages and treat them properly. Respiratory sounds include information about a person's health and well-being. It is crucial to assess respiratory sounds regularly and effectively. Commonly, physicians use stethoscopes to listen to RS and assess the patient's status according to their knowledge and hearing abilities. Although this assessment procedure is cheap and easy it is not always consistent since respiratory sounds are hard to assess and diagnosis consistency varies depending on the stethoscope, physician's hearing abilities, and education level. With developing technology, this assessment procedure can be supported by machines. In our case, artificial intelligence (AI) is developed to classify respiratory sounds as normal or abnormal by using the ICBHI 2017 Challenge dataset. Our concern is to use signal pre-processing and the Convolutional Neural Network (CNN) method to train our artificial intelligence with the ICBHI 2017 Challenge dataset. This dataset contains 6898 respiratory cycles, which is still not enough to train deep learning networks. Because of that, data augmentation with signal processing techniques was used. Also, the evaluation of CNN performance and enhancing the rate of successful classification is concerned.

5 AUTOMATIC PAINT COLOR MIXING SYSTEM

Yunus Bilen

Danışman: Assoc.Prof.Dr. Damla Kuntalp

ÖZET

In the recent years, automatic paint mixing systems have become a significant development in the painting industry. An automatic paint mixing machine is a device that automates the mixing procedure in painting. To minimize human error and procedure paint mixtures of the highest caliber, the machine carefully meauseres and mixes paint components in predetermined ratios. Paint suppliers, painters, and other industrial users regularly use automatic paint mixing devices. Additionally, they save time and money by providing faster and more effective paint mixing. Although these projects can be designed using different materials and algorithms, the general operating principle is almost the same in all of them and is based on the logic of three primary colors coming together to from a color catalog. The machine prototype design last spring was made operational this spring based on the selected materials and calculations.

6 GENERATION JULIA SCRIPT PACKAGE FOR AUTOMATIC DESIGN AND ANALYSIS OF FRACTAL ANTENNAS IN ANSYS HFSS

Mert Tamer

Danışman: Prof. Dr. Yeşim Zoral

ÖZET

The idea and purpose of this project is to create a pratic way for antenna design. Especially, the project prepares a proper background for the special geometry antennas by using software applications. This proper background is provided by using transform algorithms for the generation of geometries and script algorithms to draw these geometries and necessary components for simulations. Algorithms were created by typing codes in the Julia Programming Language. Demonstrations were made on the ANSYS HFSS Simulation Environment to obtain the design results. After obtaining special geometries, other necessary components and shortcuts for simulation on the ANSYS HFSS environment were developed in this software background. Sometimes, using the ANSYS HFSS menu is an easier way than creating software help, because of that, the developed software was focused on making design easier. According to the obtained results, the special geometries of Koch's and Minkowski's fractals and fractal interpolated functions were created successfully by using written functions of the Julia2Hfss package. By using the fractal interpolated function, firstly, a dipole antenna design was formed and simulation results show once-iterated dipole antenna gives 2 operating frequencies and a twice-iterated dipole antenna gives us several operating frequencies more than 2. Secondly, Fractal Interated Patch Antenna was formed in Ansys HFSS simulation environment by using the Julia2Hfss Package. As seen from the report the optimum design parameters were chosen and the desired design was caught.

This design was analyzed and its working condition provides the requirements. After that this antenna was printed and some necessery measurement was done. The measured and simulation results were compared to each other. Finally, some errors in the manufacturing process were introduced and their solutions were explained. The numerical results can be found from following report.

7 CONTROL OF WELDING MACHINE

Utku Cankılıç

Danışman: Prof. Dr. Eyüp Akpınar

ÖZET

The designed full bridge DC-DC converter has a power of 250 W and is fed from 310 V DC input voltage. Input DC voltage is supplied from the AC grid with the help of a diode bridge rectifier. The designed full bridge phase shifted zero voltage switching DC to DC (FB-PS-ZVS DC-DC) converter has 48 V output voltage and 4.8 A output current values. The output voltage is isolated from the input voltage. Isolation is provided by a high-frequency transformer. DC voltage is first converted to a square wave AC voltage at 50 kHz frequency. At the secondary of the high-frequency transformer, this voltage is reduced within the turns ratio and rectified through the diodes that can operate at high frequency. After rectification, full DC voltage is created at the output by passing it through a low-pass filter created by a coil and DC electrolytic capacitors. The high-frequency transformer used in this circuit helps to adjust the secondary voltage and creates isolation between the primary and secondary sides. This proje includes circuit design, PCB design and simulation results of the FB-PS-ZVSDC-DC converter

8 EFFECTS OF PV SYSTEMS ON POWER SYSTEM AND RELATED REGULATIONS

Oğuzhan Gül

Danışman: Prof. Dr. Eyüp Akpınar

ÖZET

As energy demand continues to increase worldwide, the need for clean and sustainable energy sources instead of traditional power plants based on limited resources also increases. Limited fossil resources, rising costs and ecological impacts have pushed many countries to seek alternative energy sources. Solar energy stands out as a clean energy source for electricity generation through photovoltaic (PV) systems. However, the integration of PV systems into power systems can have positive as well as negative effects on power systems, depending on various factors such as penetration level, system design and operational issues. In this research, a literature review was conducted focusing on solar energy-based electricity production, photovoltaic-based distributed energy production (DG) and the main challenges that arise in the grid integration process of this production. Solar-photovoltaic energy systems are normally connected to the power grid through fast-response power converters without any inertia, leading to reduced power system inertia. Synchronous inertia has never been a problem as more than needed is available, but with the increasing penetration of renewable energy generation without rotating shafts, the synchronous inertia ratio is decreasing significantly. For the reliability of the distribution line, load and production must be balanced and a controlled grid connection is required. In addition, PVDG must be able to connect and disconnect from the system when necessary. The power generated by PVDG cannot be continuous, so high penetration of PVDG will reduce the reliability of the power system, because as the penetration of PVDG increases, the security of the

power system will be compromised due to the insufficiency of the inertia of the power grid. In the past, there was not enough research on this subject, but research has intensified today. In this project, Virtual Synchronous Machine, a control algorithm that allows an inverter to operate like a traditional electromechanical synchronous machine will be examined and tested with an equivalent circuit in Simulink. Research on VISMA has been concentrated to overcome the network stability and quality problems that are worsening with increasing integration of DG units into the grid. Compared to conventional power plants dominated by synchronous machine, DG units are either smaller or do not have damping effect due to the rotating mass. It is expected that weaknesses can be compensated by the VISMA-based control method and thus power system quality can be improved. If the solution can be produced permanently, there will be no need to restrict the penetration level of DG sources. This research examines problems related to solar energy systems, working principles of PV cells, low and high integration of PVDG, and will focus on the simulation of VISMA-based control method, which has potential to provide solutions to decreasing power system inertia.

9 A SINGLE-PHASE NEUTRAL-POINT-CLAMPED PWM INVERTER SUPPLIED FROM THE PV

İsmail Taştepe

Danışman: Prof. Dr. Eyüp Akpınar

ÖZET

Increasing popularity of renewable energy sources in recent years has risen the importance of power electronic technologies. PV panels, which convert sunlight directly into electricity, make it possible to produce electricity from solar energy. However, power electronic circuits are needed to make this generated electricity usable in homes and workplaces. Power electronics consists of circuits that can convert the direct current (DC) to the alternating current (AC) or vice versa under process control. DC power produced by PV panels can be integrated to the AC electrical power system with the help of power electronics systems. In this context, power electronics technology represents an important step towards a sustainable energy future by ensuring more widespread and effective use of electricity obtained from renewable energy sources. The aim of this project is to control and analyse a single-phase neutral point clamped inverter (NPC) circuit using pulse width modulation when the input terminal is connected to PV panels. NPC-PWM outputs alternating current (AC) converted from direct current (DC). The modulation technique recommended for this project is the sinusoidal PWM technique. This technique is used to control the switching sequences of switching devices. The other objective of this project involves analyzing maximum power point tracking (MPPT) using DC to DC (boost converter). MPPT extracts maximum power from solar panels. This project presents the necessary designs and examines the problems in line with the stated objectives. Within the scope of the project, a printed circuit design was made to produce and realize the necessary signals for the single-phase inverter.

10 A 3-PHASE NEUTRAL-POINT-CLAMPED PWM INVERTER FED FROM PV PANELS

Burak Özdemir

Danışman: Prof. Dr. Eyüp Akpınar

ÖZET

Power electronics encompasses the technology and systems used for the efficient conversion and control of electrical energy. This field plays a central role in critical applications such as the integration of renewable energy sources, electric vehicles, industrial automation, and energy conservation. Power electronics devices contribute to the development of sustainable energy solutions by minimizing energy losses and enhancing energy efficiency. Therefore, power electronics is vital for the effectiveness and sustainability of modern energy systems. In particular, the inverters hold a critical role in solar energy systems. Solar panels convert sunlight directly into electrical energy, producing DC electricity. However, most electrical devices used in homes and workplaces operate on AC, so this DC electricity needs to be converted into AC. Inverters enable this conversion, making it possible to use solar energy in daily life. This study involves the design of a three-phase neutral-point clamped pulse-width modulation (PWM) inverter and the analysis of the output voltage waveform to minimize harmonic distortion. Two different modulation techniques, sinusoidal pulse width modulation (SPWM) and selective harmonic eliminated - pulse width modulation (SHE-PWM), are applied, and harmonic distortions are compared through simulations. To evaluate according to standards, filter recommendations are provided to suppress higher harmonics. The study examines the necessary circuit designs for implementation and addresses potential issues. It includes the design of printed circuit boards and the generation of signals for switching. Finally, price analyses and recommendations for future work are provided.

11 A BATTERY CHARGER FROM THE PV PANEL BY USING THE MAXIMUM POWER POINT TRACKER CONVERTER

İrem Acar

Danışman: Prof. Dr Eyüp Akpınar

ÖZET

The main purpose of this study is to design an MPPT (Maximum Power Point Tracking) board. MPPT board is a DC-DC converter board. In line with the solar panel and battery planned to be used in the design, the MPPT board contains a Boost Converter DC - DC converter circuit. In our previous study, the values of circuit elements such as minimum inductor, minimum capacitor of the boost converter circuit were calculated according to the input and output voltage values. The MPPT card finds the maximum point of the panel using different algorithms using a microcontroller. In this research work, these algorithms were explained and as a result, it was decided to use the Perturb&Observe algorithm. In this study, the Boost Converter structure, calculations and Perturb&Observe algorithm, which are examined in more detail in the research study, will be discussed first. The properties of the circuit elements of the basic boost circuit selected as a result of the calculations will be examined. In the Method section of the study, firstly, the selection of the necessary integrals for the MPPT board and the examination of their properties are emphasized. Then the steps in the design program are explained. First the schematic design was made and then the PCB design was completed. In the last part, the STM code written for the board is explained. When the project is considered as a whole, an MPPT card was designed to maximize the power from the solar panel. The types of DC-DC converters and algorithms that can be used for this purpose were examined and the type of converter circuit

and algorithm to be used were decided. Calculations were made and the integrals to be used were selected as a result of research. For the design part, the design program was studied and a PCB design was completed from start to finish. The software for the algorithm was worked on and the code for the STM microcontroller was prepared. A product was created step by step from the beginning

12 CLASSIFICATION OF BREAST CANCER WITH DIFFERENT IMAGING TECHNIQUES USING DEEP LEARNING ALGORITHMS

Muhammet Emre Şendur

Danışman: Prof. Dr. Gülay Tohumoğlu

ÖZET

Early diagnosis of cancer is the most powerful way to fight against cancer. Thanks to early diagnosis, there are increases in survival rates.[1] In addition to the development of imaging methods for early diagnosis, Deep Learning algorithms also play an important role in early detection. Today's increase in the number of data and the development of hardware devices deep learning applications have yielded better results and gained more importance. In this study, binary classification was made as benign and malignant using VGG16 and Mobilenetv2 algorithms on Mammogram and Ultrasound images and their performances were compared. These mammograms were pre-processed using the CLAHE technique. As the last stage of the experiment, while all training was done with the TPUv2 hardware accelerator, additional training was done with the A100 GPU hardware accelerator and the performance over the training times was examined. As a result of the experiment, 0.950 test accuracy was obtained with VGG16 on Ultrasound data, 0.936 with MobileNetv2; 0.643 accuracy with VGG16 and 0.670 accuracy with MobileNetv2 were obtained in the training for mammogram data. For the comparison of A100 and TPUv2, it has been observed that A100 is 33.3% faster in the training time with VGG16 on Ultrasound data, and 31.58% % faster in training with MobileNetv2, that is, in general, A100 is significantly faster than TPUv2.

13 DEEP NEURAL NETWORKS FOR LEARNING TO PLAY CHESS

Mahmut Yılmaz Yırtıcı

Danışman: Prof. Dr. Guleser Kalaycı Demir

ÖZET

Chess is a game that has been played for many centuries. Kingdoms developed strategies on board and executed those on the battlefield. It is also one of the first subjects that has been researched by computer scientists for developing machine learning algorithms. Chess is a trivial game as Von Neumann described but, at its core, it is a very complex game requiring foresight into both your opponent's and one's own move. There are many ways to understand the board, like pattern recognition or evaluation function both used in machine learning methods. The studies and similarities make chess an ideal subject for research in machine learning. The goal of this project is to learn and understand the subject of AI. This study will try to uncover the mysteries of the chess game and the deep machine learning process. In this direction, the history of chess algorithms and today's high ranked chess engines will be researched. Then, artificial intelligence, machine learning, and deep machine learning concepts will be discussed.

14 DELTA ROBOT ARM FOR PICK AND PLACE APPLICATIONS

Muhammet Çelik

Danışman: Prof. Dr. Güleser Demir Kalaycı

ÖZET

In today's industry, various robots are employed to enhance production speed and efficiency. Delta robot is one of these robots. Thanks to the wide mobility of the Delta robot, it is possible to use it in various areas. One of the most common applications is pick-and-place tasks on production lines. The Delta robot operates with exceptional speed and precision compared to other robots. Moreover, unlike typical production robots, it exerts only a minimal amount of its own weight on the motors, making it an exceedingly efficient system. The basic method used in the control algorithm of the robot is inverse kinematics equations, which enable the robot to find the necessary motor angles to move to the desired position. Inverse kinematic equations were obtained by geometric operations according to the structure of the robot, these kinematic equations were turned into a function and integrated into the used code. The movement of the Delta robot is provided by three stepper motors and an STM32 development board that drives these motors with sensitive signals that enable the robot to move to the desired position. The location information required for the robot is provided to STM32 by processing the image taken from the web camera. The processing of the image is done on the laptop computer using Python-OpenCV and transmitted to STM32 via Python-serial (Pyserial) UART communication protocol. In this way, a specific object entering the field of view of the USB camera is detected, picked up by the delta robot and placed at the desired location.

15 PREDICTIVE MAINTENANCE WITH MACHINE LEARNING

Selim Vardar

Danışman: Assoc. Prof. Dr. Hatice Doğan

ÖZET

In today's world, production processes have become extremely fast and complex. An unexpected failure can cause the production process to stop. Additionally, it reduces efficiency and increases production costs. Predictive maintenance methods are used to diagnose failures before they occur. Predictive maintenance diagnoses failures by analyzing various signals such as temperature, vibration, speed, acoustic, magnetic flux, current, and voltage. Current data is commonly used because it is easy to obtain. By analyzing current data, motor faults such as interturn, bearing, and broken rotor bars can be detected. Classical methods use the frequency spectrum of the current for fault diagnosis. However, this method does not achieve the desired success in detecting broken rotor bar faults. The reason is that load fluctuations can cause a healthy motor to be identified as faulty. Therefore, this study aims to diagnose broken rotor bar faults using machine learning-based methods. In this context, firstly, anomaly detection was performed by using current data. Subsequently, features were extracted and classification was carried out using machine learning classifiers. Then, deep learning methods with the capability of automatic feature extraction were applied. In this sense, classification was performed using one-dimensional convolutional neural networks. In light of the results obtained, a hierarchical structure containing a long short-term memory network was created. As a result of the study, the best accuracy was achieved at 100% in the hierarchical structure.

16 CHAOTIC COMMUNICATION UNDER ADDITIVE NON-GAUSSIAN NOISE

Gülşah Özkaya

Danışman: Assoc. Prof. Dr. M. Emre Çek

ÖZET

In this thesis, it is proposed a non-coherent chaotic communication system under non-Gaussian noise. Although utilization of chaotic signals is a notable method especially when the security is an important aspect, these systems suffer from the channel noise and their overall performance is sensitively affected by other channel imperfections. To overcome this problem, a novel transceiver based on signal repetition is designed to mitigate the non-Gaussian channel noise at the receiver, using robust estimator. The proposed method provides median based implementation on time varying signals by filtering the samples with identical amplitudes. This type of filtering directly corresponds to location estimation which yields improved filtering performance. The BER results illustrate the enhanced BER performance in DCSK based communication system. This method is planned to provide noise filtering without resulting in increased symbol duration. Keywords: Chaotic Communication, Non-Gaussian Noise, Bit Error Rate, AlphaStable Noise, Gaussian Noise, Laplacian Noise, Differential Chaos Shift Keying, Moving Average Filter, Moving Median Filter

17 DESIGN OF A PORTABLE FINGER ECG DEVICE

Ali Sevim

Danışman: Prof. Dr. Mehmet Kuntalp

ÖZET

The goal of this project is to create a finger electrocardiography (ECG) portable device that may be utilized for cardiovascular disease monitoring and diagnostics. Given that cardiovascular illnesses rank among the leading causes of death globally, prompt diagnosis and ongoing surveillance are crucial. Because traditional ECG devices are bulky and immobile, they frequently fall short of meeting the needs for continuous monitoring. An ECG gadget that is easy to use, portable, and readily available was created for this research. The hardware and software components needed to collect, process, and analyze ECG data were identified during the project's initial phase. After a thorough analysis of sensor technology, data gathering techniques, and processing algorithms, the best options were chosen. After that, the device's design was completed and the prototype development phase began. To evaluate the device's accuracy and dependability, a number of clinical trials were carried out, and the outcomes were examined. Because of its small size and easy to use design, the newly created portable finger ECG equipment has improved accessibility and practicality of cardiovascular monitoring procedures. This technology is anticipated to have a major impact on healthcare services, particularly in enabling highrisk patients to conveniently measure their own ECG at home. For the advancement of portable health technologies in the future, this study is a significant step forward.

18 DETECTION OF ATRIAL FIBRILLATION BY A 1D CONVNET

Ayberk Gülüm

Danışman: Prof. Dr. Mehmet Kuntalp

ÖZET

Atrial fibrillation is the name of the condition we encounter when heartbeats are irregular. Whether it is persistent or intermittent, it can lead to blood clotting, coronary artery disease, stroke, heart failure, and many other health problems. The main purpose of this project is to analyze the obtained ECG recordings to detect atrial fibrillation, thereby preventing potential future health problems and enabling early treatment. To achieve the desired outcomes in this project, deep neural networks will be used. After preparing the obtained data for use by applying normalization and data augmentation methods, the goal is to detect atrial fibrillation with the help of a one-dimensional convolutional neural network.

19 INVESTIGATING ABERRATION IN IMAGING SYSTEMS

Onur Arsalı

Danışman: Prof. Dr. Metin Sabuncu

ÖZET

Optical systems are used in many areas today. Medical imaging systems, astronomy, security, automotive and military are some of these fields. These systems create a visual forms of specific areas or objects in a different way. However various optical components and engineering are needed to do this. The most important of these components are lenses which are made of glass or plastics. As in every system there are problems to fix in optical systems and main problems are aberrations which can be monochromatic or chromatic and it depends on the reason usually focal shifts of rays. Image of objects seems deformed or blurred if these aberrations are not minimized. The reason that minimize on the contrary solving completely is correction one kind of aberration affects other aberrations. Therefore minimum points of total aberration and it can be represent as a function that contains several aberration coefficients. Thanks to optical engineering lens design and combinations of them helps to correct aberrations.

20 APPLICATION OF ARTIFICIAL NEURAL NETWORKS IN DETECTION AND DIAGNOSIS OF DIFFERENT CANCER TYPES

Mehmet Postacı

Danışman: Dr. Neslihan Avcu

ÖZET

Cancer is one of the most common diseases of our time. In 2020, it was reported that one in every six deaths was due to cancer, which is an important data point highlighting the seriousness of the disease. Early diagnosis aims to minimize the damage caused by the disease, which can lead to fatal consequences if left untreated. Cancer can be diagnosed through several different methods. In this thesis, the status of the cell being cancerous was examined through microarray data, which represents its genetic structure. Microarray data obtained from cancerous and healthy samples were used. Microarray data has been frequently used in cancer disease diagnosis recently. Microarrays are data sources that determine gene expression and can be used in the diagnosis or classification of cancer. In this method where the relationship between microarray data and cancer is examined, gene expression data is analyzed using statistical and machine learning techniques. In this thesis, three statistical filter approaches were used as feature selection methods to obtain a significant subset of genes. These data preprocessing steps were applied to reduce noise and emphasize significant features. Classification algorithms such as support vector machines, multilayer perceptrons, random forest algorithm, and nearest neighbor algorithm were used to test feature selection algorithms and classify cancer types.

21 REALIZATION OF AN AUTOMOTIVE RADAR SYSTEM EMPLOYING FREQUENCY MODULATED CONTINUOUS WAVE (FMCW)

Berkay Aydın

Danışman: Prof. Dr. Olcay Akay

ÖZET

This project aims to use FMCW technology in a radar system to detect both the range and speed of vehicles. FMCW radar systems can use various modulation methods, but in our project we used a linear frequency modulated (chirp) signal. Linearly varying the frequency of the transmitted signal over time creates a consistent chirp rate. The reasons for choosing this modulation technique are easy implementation and cost-effectiveness compared to other modulation techniques. Frequency Modulated Continuous Wave (FMCW) radar is a critical technology in modern autonomous driving systems. FMCW radar systems use a continuously transmitted signal whose frequency varies linearly over time, known as the linear frequency modulated (FM) or chirp signal. The chirp signal bandwidth determines the maximum detectable range and speed of the target. The resolution of this system is determined by the frequency of the system. Higher frequency has better resolution than lower frequency. Reflected signals from targets are mixed with the transmitted signal to produce pulse frequencies, which are then analyzed using the Fast Fourier Transform (FFT) algorithm to extract range and speed information of the target. With this signal processing technique, FMCW radar can determine the speed and range of vehicles and other objects at an acceptable level. FMCW radar presents significant advantages such as high resolution, robustness in adverse weather conditions, and the ability to detect both stationary and moving objects. These features make it critical for automotive applications where it

increases safety and reliability. Increasing the frequency of the system requires more work in terms of cost and complexity. In general, the FMCW radar is set up to work with other systems in the vehicle. By utilizing multiple systems instead of a singular one, autonomous driving becomes significantly safer.

22 AGE AND GENDER RECOGNITION BASED ON VOICE DATA WITH MACHINE LEARNING

Uğur Kardeş

Danışman: Prof. Dr. Olcay Akay

ÖZET

The significance of voice recognition systems has increased dramatically due to the quick advancement of technology, the rise of big data technologies, and the expanding interest in data processing and storage techniques. In speech-based applications, figuring out the speaker's gender and the range of his/her age is quite important. Research on the identification of children's voices has become more significant in several fields. This covers both the early detection of certain speech impairments in children, such as dyslexia, and the creation of engaging instructional gaming applications. In criminal scenarios like kidnappings, threatening phone calls, and deceitful reports, access to data that better specifies the speaker's unique qualities is critical and research efforts on differentiating adult voices becomes even more important. This type of research is also relevant when it comes to enhancing customer identification or giving preference to senior and child voice profiles when making calls to police stations or hospitals. In this project, various machine learning techniques and structures are applied on diverse datasets to train a model to estimate the age and gender of a speaker. In order to train the model, we analyzed audio recordings that we have collected from datasets. The system must be taught with as much data as possible in machine learning projects for it to be successful. As a result, several techniques such as data augmentation to enhance training datasets are envisioned. Our eventual objective is to generate and handle our own datasets after using open-source data for model training and testing. In conclusion, we created a reliable model for predicting age and gender. We also intend to evaluate our model's performance using our own data.

23 MOTOR FAULT DETECTION AND CLASSIFICATION VIA ARTIFICIAL INTELLIGENCE

Barkın Şener

Danışman: Prof. Dr. Olcay AKAY

ÖZET

Industrial motors have a large impact in modern industry. They play an important role such as converting electrical energy into mechanical power in a wide range of applications such as power generation, petroleum and natural gas, mining, and manufacturing. Unfortunately, a failure in an industrial motor in one of those applications could cause major economical losses. Besides this, human lives are also put at risk due to the chance of an explosion or fire. Therefore, it is crucial to diagnose the cause of the failure in a short time. In this project, several artifical intelligence algorithms such as decision tree learning, clustering and neural networks were used in order to train models that will recognize the fault type of an industrial motor. The data used for this project was obtained free of charge from the Machinery Fault Database (MAFAULDA for short). The dataset includes five different cases of motor conditions: “horizontal misalignment fault in motor shaft”, “imbalance fault”, “healthy”, “overhang cage fault”, and “vertical misalignment fault in motor shaft”. Every case contains several data such as tachometer, microphone and accelerometer data in different directions. Raw data is preprocessed for better classification performance. After this step, classification is realized using both raw data and preprocessed data. Python programming language was used in this project for its handy libraries such as Tensorflow and Scikit-learn via Jupyter Notebook . Lastly, after the classification was done, the performance of the algorithms was tested

24 IMPLEMENTATION AND APPLICATIONS OF SAVITZKY-GOLAY FILTERS

Melisa Esen

Danışman: Prof. Dr. Olcay AKAY

ÖZET

Noise is a major problem in electronics and signal processing. Therefore, filters play an important role in modern technology to suppress unwanted signals or noise. Savitzky-Golay filter was developed in 1964 by Abraham Savitzky (1919-1999) and Marcel J. E. Golay (1902-1989) to smooth analytic chemistry data. For smoothing operation, these filters use local least-squares approximation. This method of smoothing helps to decrease unwanted noise while preserving the original shape and height of the peaks in the waveform. Savitzky-Golay filters are used in applications such as extracting primary heart sound signals in heart rate monitoring, eliminating seismic random noise, and electrocardiogram processing. They are also used in multidimensional form and applied in image processing applications such as ultrasound and synthetic aperture radar. The purpose of this project is to understand the theory of Savitzky-Golay filters and perform the design on MATLAB computing software. Firstly, digital FIR filters were studied to form a basis of the theory. After that, design of Savitzky-Golay filters was examined in detail. Design specifications were learned. Using MATLAB computing software, FIR filters were examined. After that, two algorithms for implementation of Savitzky-Golay filters were written and applied on MATLAB computing software. The two algorithms are tested on different signals and compared with functions related with the Savitzky-Golay filter such as sgolayfilt. Finally, in the last part of the thesis, we propose a highpass design of Savitzky-Golay filters.

25 INVESTIGATING PROPERTIES OF DIFFERENT SLIDING DFT (SDFT) ALGORITHMS

Emre Bıkmaz

Danışman: Prof. Dr. Olcay AKAY

ÖZET

In this project, properties and advantages of Sliding Discrete Fourier Transform (SDFT) algorithms and their differences with the Discrete Fourier Transform (DFT) algorithm are analyzed. SDFT algorithm is similar to DFT and provides advantages over DFT in terms of computational complexity. This algorithm differs from the DFT in that instead of calculating all DFT bins, it can only calculate desired frequency bins. In some applications, if we need to know only the kth bin of the DFT, it is unnecessary to use the Fast Fourier Transform (FFT). This is because FFT calculates Fourier transform (FT) signal for all frequency bins. With the SDFT algorithm, we can avoid this computational burden and can calculate FT only at desired frequency bins. In this project, different SDFT algorithms such as modulated SDFT are investigated with their advantages and disadvantages. In addition to the SDFT algorithm, Goertzel algorithm which also works on the same logic, is studied as well. The advantages of the so-called sliding Goertzel filter are analyzed. In addition, error between the output of the SDFT algorithm and the true DFT results is calculated. In light of these results, the importance of the margin of error depending on the usage area is analyzed. In addition, performance of SDFT in noisy environments is analyzed in comparison with DFT. MATLAB computer software was used throughout the project.

26 SWEAT ACIDITY SENSOR BASED ON CONDUCTIVE YARNS

Gökberk Demirbakan

Danışman: Dr. Özgür Tamer

ÖZET

Technological advancements have begun to manifest themselves in the field of sports, as they have in every other area of life. The use of wearable sensors and smart textile products has brought significant innovations to the monitoring of athlete performance and sports physiology, enabling more efficient health tracking for athletes. The focus of this study is the development of conductive yarn-based pH sensors to monitor athlete performance. Analyzing sweat, especially measuring the pH value of sweat, provides important information about the balance of sweat acidity and the overall health status of the athlete. These sensors perform real-time monitoring, allowing coaches and technical staff to assist decision making regarding the athlete's performance regimen and health status. This study addresses the development of acidity sensors using conductive yarns. It investigates how the sweat analysis is conducted and how the results of this analysis are evaluated. The examinations were conducted by simulating sweat in a laboratory environment. The general scope of the project aims to monitor the ECG, heart rate, body temperature, and movement data of athletes using a smart shirt. Research has been conducted to achieve this goal. After the research, sensors to be used and suitable components for these sensors were identified and PCB design was completed. Subsequently, tests were conducted on the printed circuit board and assembly was carried out. Finally, connections of the designed shirt to the PCB were made using conductive yarn and data from the shirt worn by the athlete were obtained via a Bluetooth module.

27 CONDUCTIVE YARN BASED RESPIRATION SENSOR DESIGN

Bekir Berkay Öztürk

Danışman: Dr. Özgür Tamer

ÖZET

This project aims to design smart t-shirts to measure the performance of athletes by measuring various data such as respiration rate, heart rate, body temperature, and pH using a microcontroller connected to various sensors and communicating via Bluetooth. The findings of this research project hold significant promise for the advancement of wearable technology and its potential impact on healthcare care and lifestyle monitoring. Measurement of breathing data in the body can help to understand the health and performance of athletes. Breathing measurement is the process of determining an individual's breathing rate and depth, and is an important parameter in the field of health. Therefore, it is a critical tool for assessing the health of a person's respiratory system and detecting respiratory problems. Integrating a breathing sensor into a t-shirt will enable instant monitoring of these parameters in the athlete's body during training. In this project, respiration sensors in the literature were examined and the most appropriate method was determined. Research on the methodology revealed the following, sensors that can be used have been identified, and research has been carried out on how to connect these sensors to the body.The Breath sound was taken over the body with the help of a mems mic. The frequency range of the breath was found from the raw audio data. Denoising filters were applied. Peak detection was performed on the obtained data. As a result, the number of breaths taken per minute was calculated.

28 BLUETOOTH BASED HOME APPLIANCE COMMUNICATION INFRASTRUCTURE DEVELOPMENT

Deniz Okan Taşpınar

Danışman: Dr. Özgür Tamer

ÖZET

White goods are widely used throughout the world. In the modern world, time is a scarce commodity, which means that time-consuming challenges, such as housework, need to be solved quickly [10]. The traceability of not only white goods, but also all kinds of mechanisms, plays an important role in the advancement of engineering. For this reason, modernizations have been made from the past to the present. The project aims to create a system in which the data of white goods, which are currently collected in a wired way with UART, can be received with Bluetooth Low Energy, transferred to Google Cloud with a plug-in module designed and directly monitored with a mobile application. The mobile application can be used in all white goods, so it can be integrated into all applicable systems instead of being a generic system. The module design will be designed to provide flexibility in connection. Users will be able to connect this module to their white goods via a connector, disconnect it at any time and connect it to other white goods.

29 TEXTILE INTEGRATION OF SENSOR USING CONDUCTIVE YARNS

Emin Erkan Yıldırım

Danışman: Dr. Özgür Tamer

ÖZET

The aim of this project is to produce sportswear as a result of the integration of sensors into textiles with conductive yarns. In wearable technologies, the integration of sensors with textiles is an important parameter in terms of not restricting the user's movements. This thesis focuses primarily on textile integrations using conductive yarns and their impact on human life. It discusses studies on this subject and presents the results to the reader. In the following stages of the thesis, the developed athletic wear and integrated sensors are mentioned. The sensors mentioned here are discussed together with their intended use and presented with side contents that can be used outside of their main purpose. Finally, the studies completed within the scope of this project and the results of these studies are explained. On the basis of these results, we discuss what kind of progress can be made. This research aims to contribute to three main areas: Ergonomics in wearable technology with a focus on the design and user experience of wearable devices. Low power consumption in wearable technology through the use of Bluetooth Low Energy (BLE), an efficient communication protocol. Integration of various sensors into the human body with conductive yarns to collect data without compromising the wearer's comfort.

30 4 AXIS CNC CONTROLLER WITH CNC INTERFACE

Doğukan Sarı

Danışman: Dr. Özgür Tamer

ÖZET

This thesis presents a comprehensive study on the control, configuration and G-code programming of 4-axis CNC machines. Our project aimed to produce complex geometric shapes, such as helical gears, using a 4-axis CNC machine. In the initial phase of our work, the power requirements of the components were determined and appropriate power supplies were selected to meet these needs. Circuit breakers and voltage-current measurement tools were used to ensure safe and efficient energy distribution. In our CNC machine, four Nema23 step motors were used and motor drivers based on TB6560 ICs were chosen to control these motors. These drivers were integrated with the GRBL controller (Arduino Mega) to control the direction, speed, and current draw of the motors. The main control unit of the CNC machine was a Raspberry Pi, which synthesized G-code commands and managed file operations. The Raspberry Pi provided user interaction via a keypad and communicated with the GRBL controller through a USB interface. One of the most notable achievements of our project was the production of highprecision components such as helical gears. This achievement showcases the technical capabilities and accuracy of our project. Additionally, the GRBL software used in our project and the command-sending mechanism developed with the Raspberry Pi offer a more comprehensive and flexible control system for CNC machines. The contribution of this work to the literature lies in its innovative approaches to the control and configuration of 4-axis CNC machines. The high accuracy and repeatability advantages provided by CNC technology enhance quality and efficiency in industrial production processes. Our thesis expands existing knowledge in this field by developing new methods and applications in CNC machine control and G-code programming.

31 WEARABLE TECHNOLOGY JERSEY DESIGN USING RSL10 THAT COMMUNICATES VIA BLUETOOTH

Ebru Alaca

Danışman: Dr. Özgür Tamer

ÖZET

Nowadays, with the advancement of technology, the importance of wearabletechnologies has increased. Data obtained from wearable technologies have made people'swork much easier. Although it has many uses, it has gained an important place in our lives inthe field of health and sports. When we look at the currently produced devices, especiallythanks to the devices and clothing used while doing sports, a person's data such as ECG, temperature and pulse can be easily measured and followed for the athlete's healthanddevelopment. In this project, it is aimed to design a smart t-shirt using a microcontroller developedspecifically for volleyball players, connecting various sensors and communicatingviaBluetooth to measure the performance of the athletes. For this purpose, first, the literature was scanned and previous studies were examinedto give ideas during the process. Subsequently, the design stages of the circuit boarddesigned within the scope of the project are summarized. After testing the printedcircuit board, the software and Bluetooth communication phase were mentioned. Finally, conductive yarns were integrated into the purpose-designed T-shirt, allowing data tobereceived through the T-shirt with the help of the sensor and the designed PCB. Thanks to the implementation of this project, the conditions of the athletes duringbothtraining and during the match can be monitored easily and ergonomically, which is essential for the athlete's health.

32 FPGA IMPLEMENTATION OF GAUSSION FILTER FOR IMAGE PROCESSING APPLICATIONS.

Engin Deniz

Danışman: Prof. Dr. Uğur Çam

ÖZET

In today's world,ıimage processing techniques play a crucial role in various sectors such as military, the food industry, agriculture, robotics, and medical imaging, including applicationsılike Information Retrieval, Face Recognition Systems, Image Enhancement, and machine vision. Imageıfiltering methods are commonly employed to eliminate undesirable data, often referred to as noise, from images. Popular image filtersıinclude the median filter, Gaussian filter, mean filter, Sobel edge filter, min filter, and max filter, each serving specific purposes in cleaning and enhancing images. Model-based design hasıemerged as a recent trend, offering significant advantages over traditional design methods reliant on coding. Through model-based design, designers can articulate complex circuit structures and mathematical equations using elementary blocks, visuallyırepresenting the system they are i working on. The automatic code and test generation feature stands out as a keyaspect of model-based design. Furthermore, the frequent analysis during the development process contributes to time and cost savings compared to traditional design methods. MATLABiSimulink has been utilized for this project as a model-based design tool. This thesis focuses on developing a GaussianiFilter design applicable in the FPGA (Field Programmable Gate Arrays) environment using model-based design techniques. Model-based design methodology was used in theiMATLAB Simulink environment during the design process. Filter designs were createdіusing Simulink, an integral part of the MATLAB ecosystem, and the results were examined. The designed filter enabled Verilog codes to be generated

by utilizing the HDL (Hardware Description Language) Encoder. These source codes were transferred to the Xilinx Vivadoiprogram without any problems and the synthesis process was carried out. In addition, this I filter, which was created and formulated using HDL Coder compatible blocks in MATLABiSimulink, was verified by simulation in the Simulink environment and passed HDLiCoder tests without any problems. The application scope of the designed filter is imagei processing applications. This thesis explains in detail the detailed design methodologies, simulationiresults and synthesis results.

33 MODEL BASED DESIGN OF IMAGE EDGE DETECTION ALGORITHMS FOR FPGA IMPLEMENTATION

Burçin Demirci

Danışman: Prof. Dr. Uğur Çam

ÖZET

Edge detection aims to identify and highlight boundaries or edges in an image for image processing purposes, representing areas where changes in intensity, color, or texture occur and indicating transitions between different structures or objects in the image. The fundamental goal of edge detection algorithms is to find and summarize these abrupt changes that can indicate object boundaries, shapes, or textures. There are various methods for edge detection, with Sobel edge detection being one of the most preferred techniques. Alongside Sobel, Canny edge detection, known for its high accuracy and sensitivity, minimizing false detections due to noise, is also discussed. In this study, the comparison and explanation of Sobel edge detection with other methods have been addressed. This comparative analysis was observed through a simulation study conducted using MATLAB, a high-level programming language and interactive environment used for numerical computations, data analysis, visualization, and algorithm development. MATLAB also simplifies the implementation of edge detection algorithms by offering a wide range of algorithms in this field. With pre-adapted functions and comprehensive library support, MATLAB simplifies the implementation of complex algorithms and the analysis of results, speeding up the prototyping process and supporting algorithm development by enabling visualization and analysis of results. The edge detection studies conducted in MATLAB will later lead to the generation of optimized code for FPGA (Field Programmable Gate Array) using HDL (Hardware Description Language) encoding. FPGA is an integrated circuit type that

allows the design and restructuring of digital circuits, often preferred for applications requiring hardware functionality such as rapid prototyping, digital processing, image processing, and data processing. Additionally, model-based design is discussed in this study. This method embraces model creation and usage as a fundamental step in the development process. It supports steps such as analysis, design, simulation, verification, and automatic code generation, facilitating the creation of models for operation and streamlining our work processes. The aim of this work is to perform model-based design of image edge detection algorithms for FPGA implementation. In work, edge detection algorithms such as Sobel and Canny Edge Detector have been designed and implemented for FPGA using HDL Coder.

34 FPGA BASED IMPLEMENTATION OF CASCADED INTEGRATOR COMB (CIC) FILTER

Görkem Orakbiçen

Danışman: Prof. Dr. Uğur Çam

ÖZET

A class of digital linear phase finite impulse response (FIR) filters, known as cascaded integrator-comb filters, are used for decimation (reducing the sampling rate) and interpolation (increasing the sampling rate). They require no multipliers and utilize limited storage, making them an economical alternative for specific applications compared to traditional methods. A filter in this category consists of cascaded ideal integrator stages operating at a high sampling rate and an equal number of comb stages operating at a low sampling rate. Design procedures, examples, and frequency response analyses are provided for both decimation and interpolation filters. In this project, a cascaded integrator-comb filter design was realized using a Model-Based Design approach. This methodology, which has gained popularity in recent years for filter designs, offers a user-friendly and functional approach, distinguishing itself from traditional design methods. This enables designers to create effective and efficient designs without grappling with complex structures or intricate coding processes. Field-Programmable Gate Arrays (FPGAs) are ideal for meeting the parallel processing and flexibility requirements of cascaded integrator-comb filters due to their reprogrammability, high-speed processing, and efficient operation in limited spaces. Recently, there's been a growing interest in model-based design for digital filter design, facilitated by MATLAB's userfriendly tools. In this project, a model-based design of a cascaded integrator-comb filter was carried out using MATLAB tools. The HDL Compiler is part of MATLAB's toolbox, enabling the generation of synthesizable HDL codes from MATLAB functions or Simulink models. In subsequent steps, an HDL Coder will be used as part of

this design, and the results obtained can be implemented for FPGA-based prototypes. The primary objective of this study is to efficiently implement the cascaded integratorcomb filter using the advantages offered by FPGA. In this context, model-based design simulations conducted using MATLAB/Simulink will be realized in future stages through the HDL Coder.

35 SIMULATION AND REALIZATION OF FRACTIONAL-ORDER FILTERS

Çağın Kaya

Danışman: Prof. Dr. Selçuk Kılınç

ÖZET

A fractional order filter is a type of filter that contains fractional order elements. This study introduces fractional order filters created by replacing one integer order capacitor with its corresponding fractional order capacitor. To observe the changes in the characteristics due to occurance of the fractional order elements, active and passive high pass filters are used. For the passive high pass circuit, the RC High Pass Filter is used, and for the active high pass circuit, the Second Order Butterworth High Pass Filter is chosen. Unlike integer order capacitors, fractional order capacitors have a frequency range where they exhibit the expected phase characteristic. This frequency range is centered around the center frequency, which is determined by the designer and should be chosen according to the frequency interval that the filters are supposed to work on. For this study, the center frequency for all the fractional order elements is set to 1 kHz. Simulations for each fractional order capacitor (for α=0.2, α=0.5, and α=0.8) is done, and the edge frequencies, which are the upper and lower limits of the frequency intervals where the expected phase characteristic occurs for each fractional order, is observed through the bode plots. Both active and passive high pass filter are also simulated for different fractional orders and their frequency responses are investigated. 3 dB drop for each fractional order is pointed out to observe the changes of filter chracteristic with the changing fractional order from a specific frequency point. In this study, active and passive high pass filters with the fractional order capacitor α=0.8 is chosen for laboratory experiments. Transient analysis on these circuits

is conducted through both simulation and laboratory measurements. During the simulation and laboratory study, signals with different frequencies are inputted to the filters to observe their filtering characteristics under various frequencies. For all simulations, LTspice software is used, and all plots presented in this study are obtained from LTspice's transient and AC analysis utilities. The simulation and laboratory results for the fractional order filters with the fractional order element (α=0.8) are compared. As the result of this comparison, it is observed that the outputs of both active and passive filters show the same attenuation behavior, with minimal changes in gains between the simulations and laboratory measurements.

36 SIMULATION AND REALIZATION OF FRACTIONAL-ORDER OSCILLATORS

Uğur Reyhan Ambarcıoğlu

Danışman: Prof. Dr. Selçuk Kılınç

ÖZET

In this study, efforts have been made to realize and design fractional order Wien Bridge oscillators.Six circuits of Wien Bridge oscillators have been simulated. To design fractional order Wien Bridge Oscillators, the fractional order capacitors are used instead of the integer order capacitors.Magnitude and phase responses of fractional order capacitors(FoC) are presented. For the experimental work, four topologies has been discussed and the effects of fractional order to the oscillation has been studied. AC analysis has been made for the fractional order capacitors with the order of 0.2,0.5 and 0.8. The characteristic equation has been derived and followed by numerical analysis.For the integer ordered Wien Bridge Network, the solution of the characteristic equation has been found and the oscillation frequency is obtained. It is seen that for a Wien Bridge network , oscillation frequency changes as the order of fractional order varies. The Wien Bridge Network has been simulated with and without using FoC and the differences between them has been presented. Then experimental work has been done for four cases by connecting FoCs to the series and parallel branch of the network. The realizations of the FoCs are presented and passive elements that has been used are presented. The oscillation frequency and the amplitude gain has been obtained in laboratory. The results demonstrate the advantages of fractional order emulators in providing the control of the frequency.Varying orders effects phase and frequency which is the purpose of using FoCs in oscillators

37 CIRCUIT REALIZATION OF MEMRISTOR EMULATORS

Yiğit Koparan

Danışman: Prof. Dr. Selçuk Kılınç

ÖZET

It is essential to design an emulator circuit for memristor since it is not available commercially. This project aims to explore and implement the realization of memristor emulator circuits. Memristors, display unique non-volatile memory and resistance switching properties. Circuits that observed in this Project use AD844, AD633, passive and active circuit elements and these emulators are theoretically analyzed and observed on simulations. Simulations are made using LTspice. Memristor emulator circuits' behaviour observed when the frequency of the input signal change. For the last part memristor emulator circuits are constructed and outputs are observed, then they are compared to the results obtained from LTspice simulations and differences are noted and discussed. The project involes the development of circuitry that accurately mimics the behavior of memristors, allowing for the simulation and testing of memristor-based systems. The successful realization of memristor emulators through this project holds significant promise for advancing the field neuromorphic computing, enabling researchers and engineers to explore memristor-based architectures and the developed emulators can serve as valuable tools for educational purposes.

38 TWO-FACTOR AUTHENTICATION SYSTEM FOR PROTECTING METADATA AND CONNECTED VEHICLES (ISO/SAE 21434)

Tolga Serbest

Danışman: Prof. Dr. Selçuk Kılınç

ÖZET

With the development of technology in the automobile industry in the past few years, software and embedded systems have gained an important place in the sector. Companies are integrating more and more software into vehicle systems. Some companies are replacing hardware systems with software systems for digitalization. As a result, security problems became one of the main topics in the industry. One of the problems is protecting the personal data (metadata) and the vehicle itself from cyberattacks, theft attempts, and other environmental threats. Hackers and thieves are adapting to new systems and developing new methods such as hacking signal tools. They imitate the remote locking signals to steal the car or personal information. For the solution, a twofactor authentication system will be developed in connected vehicles to protect metadata and the vehicles themselves. The system will consist of two main components. The first component is the central security unit integrated with the remote keyless entry system. The second component is the mobile application installed on the authorized driver's phone. When someone is trying to open the car door's lock and enter the car with the remote keyless entry system input signal, a two-factor authentication system will check if the person is authorized with the mobile application and prevent malicious attempts.

39 DESIGN AND IMPLEMENTATION OF SONAR FOR UAV SYSTEMS

Fatih Gökalp Tanyeri

Danışman: Assoc. Prof. Dr. Serkan Günel

ÖZET

The project draws inspiration from the natural echolocation found in nature. Echolocation is a method employed by mammals to detect their surroundings and navigate by emitting self-produced sound waves. In echolocation ranging is the time delay between the sound emission of the animal and the echoes received from the object around the environment. The benefits of this method have been identified through research, with findings indicating that some visually impaired individuals also derive advantages from it [1][2]. This project aims to design and implement a phased-array sonar system using an array of ultrasonic sensors based on the echolocation principle. The objective is to create a system that combines several low-cost sensors into an electronically steerable high-quality single sensor, eliminating the need for mechanical rotation. The array of low-cost sensors in this project can be likened to the ears of a mammal, while the transmitter sensors can be compared to vocal cords. Many mapping systems on the market physically rotate, leading to drawbacks such as high power consumption and maintenance costs. Our project seeks to overcome these issues by employing the phased-array sensor arrangement method. The distinctive features of the project include a 360-degree field of view, applicability to various domains, and adaptability for further development. The initial goal is to test and implement the system on an unmanned aerial vehicle developed by students in Dokuz Eylül Hava Araçları (DEHA) and subsequently make it universally applicable across different vehicles due to its modular structure. Ultimately, the project will have the capability to map the 2D terrain,

identify obstacles in the environment, gather information about the surface density of objects, and determine the device's position and relative approach speed. Potential applications include mapping solutions for indoor areas, inventory control solutions for factories, and underwater observation systems.

40 CONTROLLER DESIGN FOR UAV-SONAR ANALOGUE FRONT-END SYSTEM

Elif Sezin Özyiyğit

Danışman: Assoc. Prof. Dr. Serkan Günel

ÖZET

Animals utilize echolocation by emitting sounds that bounce back from objects in the environment. They then interpret these echoes to determine surrounding objects' location, shape, size, and even texture. The project's primary goal is to develop a phase-shifted active sonar system using arrays of ultrasonic sensors that can be electronically directed without mechanical rotation. This system is designed to make low-cost sensors perform as effectively as a single high-quality sensor, thus offering a more efficient and effective detection performance, unlike many current market mapping systems that rely on mechanical rotation, leading to disadvantages like high energy consumption and increased maintenance costs. Notable features of the system include a 180- degree viewing angle, adaptability to various environments, and a modular structure. Initially, the system will be tested and implemented on unmanned aerial vehicles developed by Dokuz Eylul Air Vehicles (DEHA) and later adapted for broader application due to its modular nature. The system consists of a transmitter circuit that generates high-power electrical pulses and a receiver circuit that analyzes the waves reflected from the target to gather environmental information. The microprocessor is equipped with phase comparison and shifting circuits to compensate for phase differences caused by both circuit components and environmental objects. A demodulation process is applied to the received wave using the phase-locked loop circuit, obtaining information about frequency deviation and using the Doppler effect for relative speed detection. The system will include subsystems to correct errors arising from the dependency of sound speed on temperature, humidity, and pressure.

41 POWER SUPPLY UNIT FOR PMSM MOTOR CONTROL CARD

Ahmetcan Karagül

Danışman: Assoc. Prof. Dr. Serkan Günel

ÖZET

The power distribution of washing machines is done by linear regulators (LDO) or switching power supplies (SMPS). Linear regulators are more susceptible to noise and are heavier and larger than switching power supplies. Switching power supplies, on the other hand, are more efficient, lighter, and smaller than linear regulators. Switching power supplies are applied with different circuit topologies such as flyback, forward, buck, boost, and buck-boost. One of the most significant disadvantages of switching power supplies applied with different circuit topologies in washing machine motor control cards is the problem that the differences in various machine functions such as washing, spin-pump, and braking have yet to be examined and analyzed in detail. Failure to investigate these differences during the design process leads to problems such as increased energy consumption, increased thermal losses, faster than standard mechanical fatigue, and efficiency. The thesis will provide solutions to these problems. It will provide longer life and more efficient motor control boards as I analyze the switching power supplies with flyback and buck topologies using circuit theory techniques, simulate them, and expose their differences by comparing them to washing machine functions.

42 LIBVIRT BASED SINGLE BOARD COMPUTER VIRTUALIZATION

Sinem Selçuk

Danışman: Assoc. Prof. Dr. Serkan Günel

ÖZET

The project focuses on the creation and stress testing of a Libvirt-based virtual network in the QEMU/KVM environment consisting of emulated Raspberry Pi devices. The primary purpose is to stress-test this configuration by programming its nodes to perform simple calculations and communication tasks. This stress testing is designed to evaluate the CPU performance and limits of the responsiveness of the virtual system. Virtualization using QEMU/KVM offers a costly effective and scalable solution for simulating Raspberry Pi clusters, which are increasingly popular in educational and amateur computing projects. The CPU performance in the project is observed using various Python packages. The time required for the execution of the calculation tasks is monitored. For communication tasks TCP/IP protocol is used and the virtual machines continuously send each other a certain file. The limits of this system have been observed. The observations gained can guide future optimizations in Raspberry Pi clusters and inform decisions about parallel processing in various computational tasks

43 SYNCHRONOUS RELUCTANCE MOTOR DESIGN

Zeki Kılıç

Danışman: Assoc. Prof. Dr. Taner Göktaş

ÖZET

This final project summarizes the design process of a synchronous reluctance motor intended for use in dryers. Firstly, a general investigation of the different types of motors used in dryers before was completed to understand why the synchronous reluctance motor that was planned to be designed should be chosen and what additional benefits it would have compared to other motors. In fact, at this point, the principle of designing and verifying a drive motor that can be equivalent to magnetic synchronous motors in clothes dryer machines, which is the starting point and purpose of the project, has been determined. After understanding the fundamental differences between other motors and synchronous motors, research was completed to understand the basic structure and working principle of synchronous reluctance motors. This research started with books, which are the sources with the most profound and accurate information on this subject, and also used many different sources to assist. This research and its results are given in detail in the Method section. As a result of this information, the motor's working principle and its general structure were clearly understood. After understanding the general structure of the motor, a detailed learning process was carried out about the rotor structure in order to proceed to the design stages. After the research and results obtained about the motor's general structure and working principle, the design of the synchronous reluctance motor, which is the project's primary purpose, was discussed. At this stage, it was decided that the best source was previous similar studies and research on these sources was started. Important information on how to start the design of a motor and what kind of optimization procedures can be applied in the future has been obtained in light of these sample studies. They are also

included in the report. Before starting the design phase of the motor, one of the most critical decisions was which simulation software to use for this purpose. In this process, it was decided with the help of previous similar projects to use the ”Ansys” program again with the help of previous similar projects. Within the framework of this decision, work was carried out on sample designs in the program to understand the program and start the motor design, and the preliminary design phase was started. After the preliminary design phase was completed, the rotor variables were optimised with parametric analyses to improve the efficiency of the motor, one of the most important factors of the motor, and and the rms armature current which directly affects this efficiency, and the final stage of the design was reached. In conclusion, this final project investigated the complexity of designing a specialized synchronous reluctance motor for clothes dryers. With the knowledge and experience gained from the challenging situations encountered, such as unconventional motor principles, critical parameters affecting efficiency, and what these parameters mean, a solid foundation for optimization was established. In the final step, the final engine was designed by carefully optimising the preliminary design based on general knowledge to produce a unique design for the desired conditions.

44 AC-DC CONVERTER DESIGN WITH UNIVERSAL INPUT (85V-265V) AND 75W OUTPUT POWER

Bora İldeş, Ahmet Sait Ünal

Danışman: Assoc. Prof. Dr. Taner Göktaş

ÖZET

Power electronics, which has an important place in today's technology, has experienced significant developments in recent years. One of the most important areas of power electronics, which has a very wide range of applications, is Switch Mode Power Supplies (SMPS). In the last 25-30 years, there have been significant developments and significant increases in their usage areas. In this process, the design of systems that can respond quickly to sudden current change demands in the load, have high energy efficiency, small size and volume, and flexible control structure has gained priority and importance. The main purpose of this thesis is to design an AC/DC converter with specified input and output values to be used in a special field by Arcelik A.S. For this purpose, firstly all SMPS topologies were analysed. Among these topologies, the most commonly used buck converter topology, boost converter topology, buck-boost converter topology and flyback converter topology are examined in detail, analysed and supported with simulation examples. As a result of the researches, it was determined that the most suitable topology for the desired features is the reversible converter topology. A reversible converter circuit has been simulated, necessary analyses have been performed, pcb (printed circuit board) design has been made and realised by explaining all steps including the determination of the parameters suitable for the design. Keywords: Switch Mode Power Supplies, AC/DC Converter, Buck Converter, Boost Converter, Buck-Boost Converter, Flyback Converter.

45 NEXT GENERATION TURBIDITY

Oğuzhan Güner, Alihan Gül

Danışman: Assoc. Prof. Dr. Taner Göktaş

ÖZET

This project aims to design an advanced turbidity sensor by modernizing an existing turbidity sensor. This new sensor aims to reduce water and detergent consumption and create an environmentally friendly system by identifying the types of dirt in the dishes and optimizing the washing algorithms. During the research process, the working principles and structure of the existing turbidity sensor were examined, and how the sensor could be improved was emphasized. Methods such as using light signals of different wavelengths to analyze liquids and control them with PWM signals were investigated and applied. An experimental setup was designed to develop new turbidity sensors capable of detecting molecular-level components. In this design phase, the absorption rates of liquid samples were determined by spectroscopic analysis, oil molecules were detected using pre-processing and data analysis methods and verified by regression analysis. The experimental set was designed with a compact structure similar to the principles of spectrometers, and absorption measurements were made by controlling different wavelengths with different PWM frequencies. Similar results were observed when the absorption results obtained with the test set were compared with the spectrometer measurements. Preprocessing and data analysis techniques were applied to the absorption measurements to evaluate the system's performance. Since these techniques require large data sets, the limited number of transmitters in the experimental setup resulted in an insufficient number of latent variables. Therefore, the measurements were validated by comparing the absorption graphs.

46 MINIMIZING SWITCHING EFFECTS FOR SCRS AND TRIACS

Ferdi Kaygusuz, Atahan Karataş

Danışman: Assoc. Prof. Dr. Taner Göktaş

ÖZET

In this project, the primary objective is to enhance the safety and reliability of Silicon Controlled Rectifiers (SCRs) employed on the mainboard of dishwashers, thereby diminishing fault rates associated with their operation. Triac can be triggered at different angles. Switching losses occur depending on this trigger angle. Losses in the triage according to different trigger angles are shown numerically. The snubber circuit is used to prevent these losses. In addition, in the case of conduction of triac, on-state losses due to internal resistance occur. This loss is entirely due to the internal structure of the material. Keeping all losses in mind, the right material selection plays a critical role. Results and analysis of the simulation model made by using Proteus software given in report. Additionally, the circuit was tested in a laboratory environment and oscilloscope outputs were compared with simulation results.

47 POWER DENSITY IN FLYBACK CONVERTERS

Necatican Toklaç, Kerem Irmak

Danışman: Assoc. Prof. Dr. Taner Göktaş

ÖZET

This project intends to increase the power density of flyback converter which in television power supply system. Flyback converter in television power supplies efficiently transforms and regulates voltage. Flyback converter design enables compact, lightweight power supplies with high power density. Several parameters to change the power density of flyback converter. In this project, these parameters are applied to the system and results will be obtained. Semiconductor devices such as MOSFET, IGBT is used to control energy transfer, allowing for high frequency switching. Results and analysis of the simulation models made by using MATLAB Simulink and LTSpice software which is given in references.

48 2-DESIGN OF THE MULTI SECTION LOSSLESS DIELECTRIC LAYERS FOR THE INPUT MATCHING

Bayram Demir

Danışman: Prof. Dr. Taner Oğuzer

ÖZET

When an electromagnetic wave enters a dielectric medium, it experiences reflection, which can be determined through various formulations. Calculating electromagnetic reflection coefficients in both single and multiple-layered systems requires individual calculations for each layer followed by a collective consideration. These computations enable the observation of the reflected wave at the input and the transmitted wave at the output. This study delves into designing multi-section lossless dielectric layers for input matching. Optimizing dielectric material properties and layer arrangements can significantly enhance microwave device efficiency and performance. The research aims to analyze multilayer dielectric structures applicable to designing lossless transmission lines and broader frequency bandwidths. The thesis scope covers electromagnetic simulations of the designed structure and discusses optimizing various dielectric layer properties and configurations. Emphasizing potential impacts on microwave device efficiency and frequency responses, the findings underscore the advantages of employing these multi-section lossless dielectric structures for input matching.

49 INDUCTANCE EVALUATION FOR TWO CO-AXIAL COIL GEOMETRY

Batuhan Sakın

Danışman: Prof. Dr. Taner Oğuzer

ÖZET

In this study, evaluation for two coupled coil geometry. Inductors, also called coils, are passive energy storage circuit component in form of magnetic field. Inductance has many uses in our life. Especially they are used for communication systems as filters. Also they are used as electronic oscillators. Inductor generally use alternating current system. For example Inductor use as transformers to increase or decrease the voltage level, generator to convert mechanical energy to electrical energy, electric motors to convert electrical energy to mechanical energy. Inductors or coil have mutual and self inductances in the circuit. If we use at least two coil we also consider the mutual inductance value for our calculations. Mutual inductance means that inductor in the circuit are effected each other in an increasing or decreasing way depending on how they are connected. In this study, we focus the different connection type of coil how the effect mutual inductance value between the these two coil. One of them is coil over the some iron core and the other one is no iron core.

50 CREATING A 3-D GRAPH OF A PIECE MOVING ALONG A PATH FROM ITS STARTING POINT TO ITS DESTINATION

Sümeyye Saban

Danışman: Assoc. Prof. Yavuz ŞENOL

ÖZET

Platforms may undergo deformation over time for various reasons, such as the objects on them and the pressure of these objects on the platform. These deformations can negatively affect the health and performance of moving parts in the system. These deformations that occur over time can negatively affect the health and performance of the moving parts of the system, which can lead to bigger problems in the system. Early detection of deformations on platforms is important in order to take quick precautions against these problems. Deformations on the platforms can be analyzed quickly with acceleration and gyroscope sensors placed on the moving object on the platform. The data obtained by creating 3D maps of the paths followed by moving objects can be used to determine in which regions and to what extent deformation occurs and to detect errors. The resulting information can be used to quickly implement corrective measures against potential problems in the system and improve system performance. In this way, early intervention for deformations in the platforms can increase the long-term durability and reliability of the system.

51 REMOTE MONITORING OF DATA OBTAINED FROM A DEVICE USING IOT TECHNOLOGY

Büşra Kaya

Danışman: Assoc. Prof. Yavuz ŞENOL

ÖZET

In today's rapidly advancing technological landscape, the concept of the Internet of Things (IoT) is making a significant impact in various aspects of our lives. IoT refers to a network system where objects can connect to the internet and exchange data. This technology combines advanced sensors, wireless communication, and data analytics to make objects smarter. The opportunities and advantages offered by IoT have a transformative effect in numerous sectors. The Message Queuing Telemetry Transport (MQTT) protocol provides an ideal communication environment for IoT applications. IoT devices publish data collected from sensors over the MQTT protocol, and other devices subscribed to this data receive it. This enables real-time data sharing and interaction among different devices in an IoT system. For example, weather data collected by weather sensors can be sent to a server via the MQTT protocol, and mobile applications or other devices subscribed to this data can receive realtime weather information. MQTT ensures data security by offering security mechanisms and authentication features. Data is encrypted during MQTT communication, providing protection against unauthorized access. This is a significant advantage in terms of the security and confidentiality of IoT systems. The MQTT protocol plays a crucial role in enabling data communication and facilitating interaction among objects in the Internet of Things. Thanks to its lightweight and efficient structure, security features, and flexibility, it has become a preferred communication protocol for IoT projects. As IoT technologies become more widespread in the future, the importance and usage of MQTT

will continue to increase. The objective of this thesis is to notify the operator or user about the status of data received from a device, along with the date and time of occurrence. Users can access this data from their phones or computers. In this process, we utilize the NodeMCU V3 ESP8266 CH340G 4MB D1 Mini V3.0 module and its Wi-Fi feature. From here, we use an MQTT broker to communicate the device's data with devices such as phones or computers.

52 ERROR DETECTION IN T-SHIRT COLLARS

Uğur Küsmen

Danışman: Assoc. Prof. Dr. Reyat Yılmaz

ÖZET

In today's textile industry, mass production processes play a crucial role. However, quality control issues in t-shirt manufacturing are common, leading to time and cost losses for manufacturers. The primary objective of this project is to utilize image processing algorithms to detect flaws in the collars of t-shirts, including errors in size, length, and stitching. The project aims to provide a rapid and effective solution to these issues. Traditional quality control methods are often performed manually, making the process susceptible to human errors. Therefore, implementing automatic quality control using image processing algorithms has the potential to detect errors more quickly and accurately. This project aims to enhance quality control processes in textile manufacturing, providing manufacturers with a more reliable and efficient production process. Image processing algorithms promptly identify errors in t-shirt collars, offering faster quality control compared to manual processes. Automatic quality control minimizes recall and correction costs by detecting errors early in the production process. Additionally, it accelerates production, resulting in time savings. The artificial intelligence and image processing algorithms under study have been applied to the collar, with each edge analyzed separately. The results, calculated according to the Mean Absolute Error. In our project MAE value is 0,255 cm To summarize the outcome of our analysis, it can be concluded that our algorithm exhibits an error margin of approximately 0.255 cm in either direction when making measurements. This error margin implies that for an object measuring 40 cm in length, the algorithm might record a measurement as anywhere between 39.745 cm and 40.255 cm. This level of precision is indicative of the algorithm's capability to maintain close accuracy within a very narrow range, making

it highly reliable for applications where such minute discrepancies can be critical. The findings underscore the potential utility of our algorithm in settings that demand exactitude, such as in precision engineering or quality control processes where even small deviations might influence the overall efficacy of the product or process being monitored

53 DIABETS PREDICTION USING MACHINE LEARNING ALGORITHMS

Sani Can Yıldırım, Bora Adalı

Danışman: Assoc. Prof. Dr. Reyat Yılmaz

ÖZET

A branch of artificial intelligence known as machine learning (ML) uses data-driven learning to enable computer systems to perform better and solve problems. The ability of machine learning algorithms to learn and get better without explicit programming for a particular task sets them apart from traditional programming methods. Preprocessing, model selection, training, assessment, and tuning are common steps in the machine learning process. Gathering and preparing pertinent datasets, cleaning, and extracting meaningful features from the data, choosing an appropriate ML model based on the problem and data, training the model to increase its predictive or classification accuracy are all important steps in the machine learning process. A wide various of algorithms, including those for classification, regression, and clustering, are included in machine learning. Trial and error are a common part of learning, and models get better the more data to which they are exposed. By automating complicated tasks and extracting insights from enormous datasets, machine learning (ML) is a widely applicable technology that is driving innovation and efficiency in a various of industries, including healthcare, finance, automotive, and e-commerce. The aim of this thesis is to determine which algorithm is more suitable for predicting diabetes by using specific blood value data and machine learning algorithms. A large blood value data set was used to predict diabetes. Decision Tree and Artificial Neural Network machine learning classification techniques were used. In this thesis, the abilities of these two algorithms to diagnose diabetes were compared. As a result, the decision tree algorithm

completed the study with 75% accuracy and the artificial neural network algorithm with 69% accuracy. By looking at these two values, it is evident that the decision tree algorithm is more capable of predicting diabetes.

54 MACHINE LEARNING METHODS IN BREAST CANCER PREDICTION

Tuğçe Pekmezci

Danışman: Assoc. Prof. Dr. Reyat Yılmaz

ÖZET

The aim of this project, developed as an undergraduate graduation project, is to predict breast cancer with machine learning(ML). By quickly processing and classifying routine blood test data obtained from many different patients, it is aimed to make early diagnosis of breast cancer, which is one of the leading causes of cancer-related deaths in women, and to reduce such death rates. Within the framework of the objectives of this project, the Breast Cancer Coimbra dataset, which contains data from 116 participants and covers 9 features, was used. These variables include body mass index (BMI), age, glucose levels, insulin levels, resistin, homeostasis model assessment (HOMA), leptin, adiponectin, and monocyte chemoattractant protein-1 (MCP-1). At the same time, the data set in question divides individuals into two groups: sick and healthy. Support Vector Machines (SVM), Deep Neural Networks (DNNs) and Artificial Neural Networks (ANNs) are crucial in modern medicine and offer powerful support to healthcare practitioners in decision making, diagnosis and patient classification. These algorithms are becoming increasingly important due to their capacity to effectively analyze medical data. SVMs excel at classifying data, DNNs are adept at distinguishing complex patterns, and ANNs serve as key components in medical decision systems. Their collective impact is profound, revolutionizing patient care and outcomes. Blood test data is meticulously pre-processed to optimize it for the creation of predictive models. In this study, SVM and Deep Learning models were developed and rigorously evaluated. Basic metrics such as precision, accuracy, recall, and F1 score were

used for evaluation., The results of this study show that the precision value reached 0.9680 with F1 score of 0.9677, recall value of 0.9677, and accuracy value of 0.9677. Such high success rates, exceeding 90%, highlight the effectiveness of the model. These findings demonstrate the effectiveness of the proposed method in facilitating early diagnosis and potentially empowering healthcare professionals.

55 EXTRACTION OF THE ELECTRICAL MODEL OF LUNG MECHANICS AND OBTAINING THE PRESSURE WAVEFORM

Hakan Altunkanat

Danışman: Dr. G. Gülden Köktürk

ÖZET

The methods, tools we develop provides us with a comfortable life. The living conditions of an average human improve. The technology has an exponential growth rate, but these innovations come with a price. Especially, the organic fuels we use in factories, vehicles and in our houses causes pollution. The quality of the air we breathe decreases rapidly day after day. The lack of consciousness leads people to develop dangerous habits like smoking. Also, the synthetical ingredients in the food we consume compromise our health. These affect our organs. One of the organs that has been mostly affected is lungs. Lungs are a vital organ for respiratory system. Lack of oxygen even for short periods of time has serious consequences. Respiratory system diseases like Chronic Obstructive Pulmonary Disease (COPD) are caused by these side effects. In this context, scientists, doctors, and engineers are conducting various studies to understand the functioning of the respiratory system, particularly the lungs. This project's focus is electrical model of lungs. The electrical model developed by Yalçınkaya et. al. will be used [9]. The model will be built on Simulink. Air pressure, air volume, air flow versus time graphics will be extracted with simulations. Suitability of mathematical analysis provided by electrical circuit solution techniques will help us dynamic structure of lungs. The extracted characteristics will be compared with real characteristic of human lungs provided by medical researchers. After that, solution-oriented potential of electrical modelling of human lungs will be covered. The

diagnose of respiratory diseases, treatment monitoring, simulation-based analysis and control of respiratory environment subjects will be discussed. Aims of the project are to determine usage of the model for these subjects, to provide a deeper understanding of lung mechanics and to prepare a guidance for the future research of lungs.

56 OBJECT RECOGNITION FROM REAL RURAL AREA IMAGES

Mesut Ulusoy

Danışman: Dr. G. Gülden Köktürk

ÖZET

Recent changes in animal habitats due to climate change have increased the need for effective monitoring of wildlife. Large datasets have been acquired through camera traps, making manual labeling impossible. Object recognition, a subset of computer vision techniques, has emerged as a solution to automatically label images. In this project, the labeling of wild animal images is performed using the YOLOv8 algorithm, a fast and novel model in computer vision. This project also reviews the work of object detection techniques such as R-CNN, SSD and YOLO in wildlife research. Applications in scenarios ranging from human-animal conflict mitigation to wildlife conservation are examined. Object recognition, encompassing image classification, localization, detection, and segmentation, is explained along with its importance in wildlife conservation. The methodology focuses on the use of YOLOv8 for object detection. The backbone, neck and head components of the YOLO architecture are described and the YOLOv8 is evaluated against performance evaluation metrics such as Average Precision (AP), Recall, Precision, F1 Score and mean average precision (mAP). The model achieved good results, with a mAP value of 95.2%, indicating the project's suitability. The project methodology includes data preparation, model training and performance evaluation metrics with YOLOv8 using Google Colab GPU and then testing the model. The model was trained using open-source datasets. In this project, it has been demonstrated that the detection and labeling of wild animals in images can be done automatically and quickly with YOLOv8. The results show that this project can contribute significantly to wildlife monitoring and efforts to reduce human-animal conflict.

57 IOT-BASED REMOTE CONTROL APPLICATIONS OF TINY HOUSES USING WIRELESS COMMUNICATION METHODS

Melih Erdoğan

Danışman: Assoc. Prof. Dr. Özge Cihanbeğendi

ÖZET

The Internet of Things (IoT) technology is gaining increasing importance, and one of its most common application areas is smart home systems. In this context, various communication technologies have been utilized to develop applications tailored to different needs and preferences. This project aims to design a smart home system for Tiny Houses, which are becoming increasingly popular. Since Tiny Houses are often located in off-grid areas, low power consumption and long-distance communication are crucial considerations for the smart home systems to be installed in these homes. In line with these needs, the use of LoRaWAN (Long Range Wide Area Network) technology has been deemed appropriate. Data communication has been established via a LoRa-enabled module and gateway through the TTN (The Things Network) server, developed for IoT applications. Additionally, integration with the server has been achieved through an MQTT-supported mobile application, making it easier for users to interpret the data. Various applications and scenarios have been created for the smart home system using several sensors. After the system prototype was developed, project analysis was conducted, and the results were evaluated. This demonstrated the feasibility and effectiveness of implementing a LoRabased smart home system in Tiny Houses.