

Traffic Sign Recognition with Self Organizing Maps

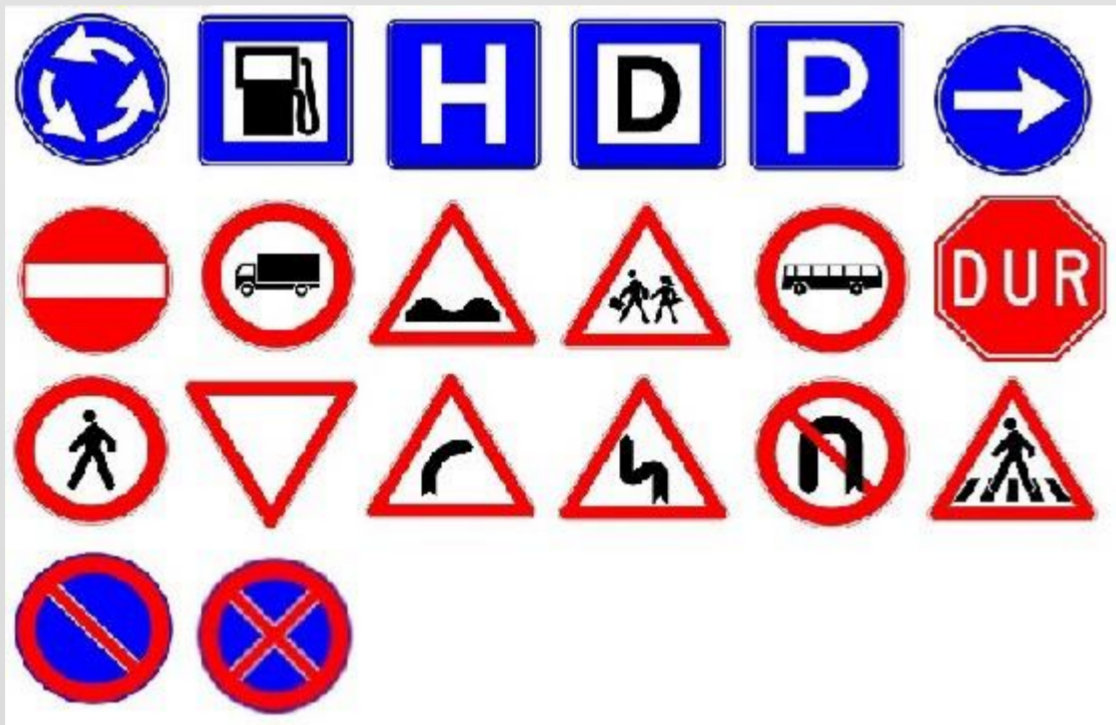
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Introduction

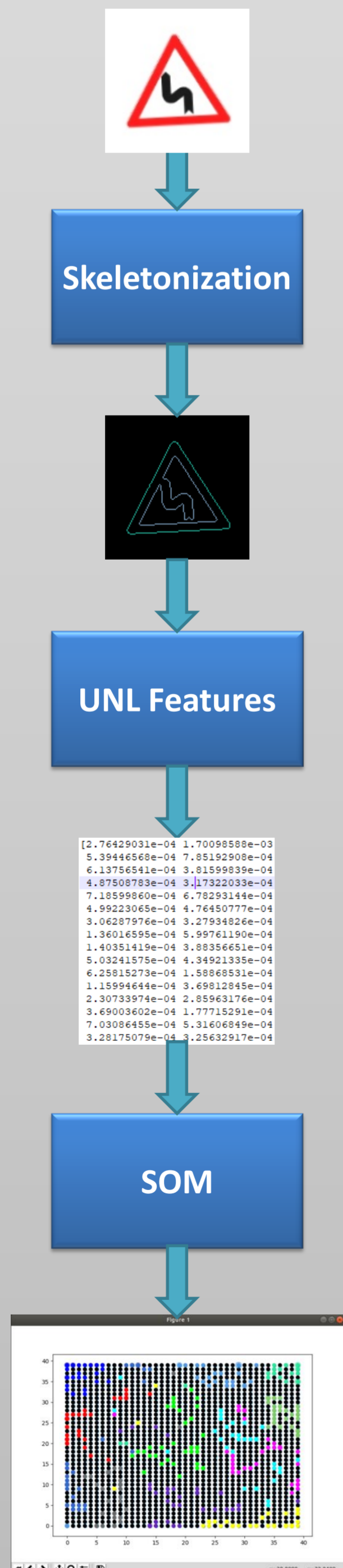
In this project, 20 different traffic signs on Turkish roads are recognized by using Self Organizing Maps and UNL Fourier Features. The project give %85.06 accuracy in average.

Dataset

The dataset consists of 1000 images that were artificially created by rotating, scaling and noising 20 different images. The dataset is splitted into 800 training and 200 testing instances randomly.

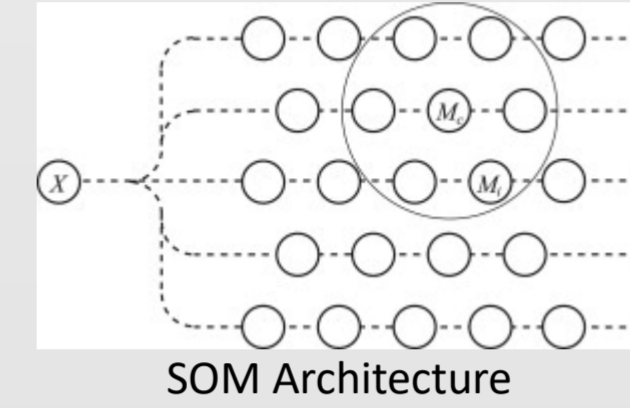


Methodology



Self Organizing Maps

Self Organizing Maps is an unsupervised, competitive machine learning technique. The most distinctive feature of SOM is that when a neuron is activated, the neighboring neurons are activated too.



$$m_i(t+1) = m_i(t) + h_{ci}(t)[x(t) - m_i(t)]$$

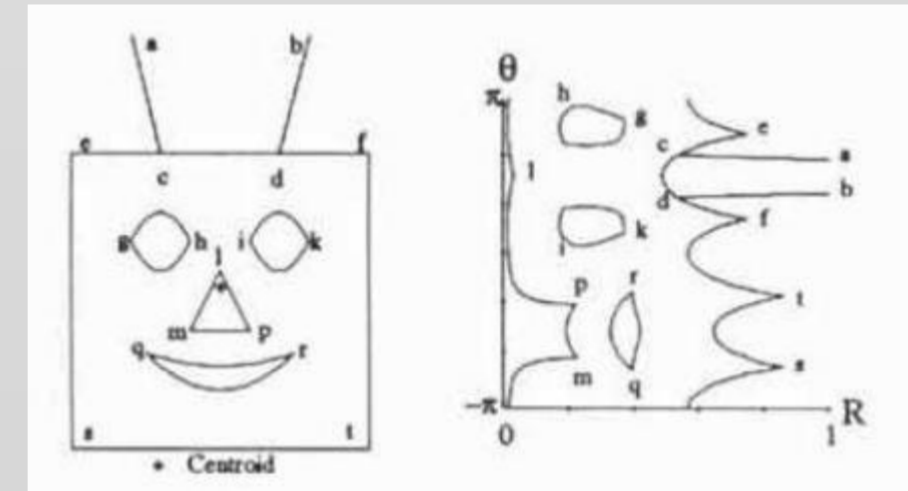
Update Formula

UNL Fourier Features

UNL Fourier Features is a feature extraction method that is rotation, translation and scale-invariant.

$$U(z(t)) = \frac{\|(x_1 + t*(x_2 - x_1)) + j*(y_1 + t*(y_2 - y_1) - O_y)\|}{M} + j \times \text{atan}\left(\frac{y_1 + t*(y_2 - y_1 - O_y)}{x_1 + t*(x_2 - x_1 - O_x)}\right)$$

All curve transformation



UNL Transform Example

Results

The overall accuracy is %85.06 in average. Learning rate, size of map, number of iterations are tuned to find the optimal accuracy.

Learning Rate	Red Accuracy	Blue Acc.	Red-Blue Acc.	Overall Acc.
0.1	84.8	85.64	84	85
0.2	83.55	84.62	87	84.3
0.3	85.64	83.62	84.8	84.8
0.4	76.6	80.96	78.6	78.6

Effect of Learning Rate on Accuracy

Size Red	Size Blue	Size Red-Blue	Red Acc.	Blue Acc.	Red-Blue Acc.	Overall Acc.
12	8	4	86.55	85.3	86	86.2
22	16	9	83.65	83.98	80	83.4
40	30	20	85.15	85.98	87	85.6

Effect of Map Size on Accuracy

Ite. Red	Ite. Blue	Ite. Red-Blue	Red Acc.	Blue Acc.	Red-Blue Acc.	Overall Acc.
480	240	80	72.59	80.62	50	73
5760	1920	320	83.32	84.84	85	84

Effect of Iteration on Accuracy

