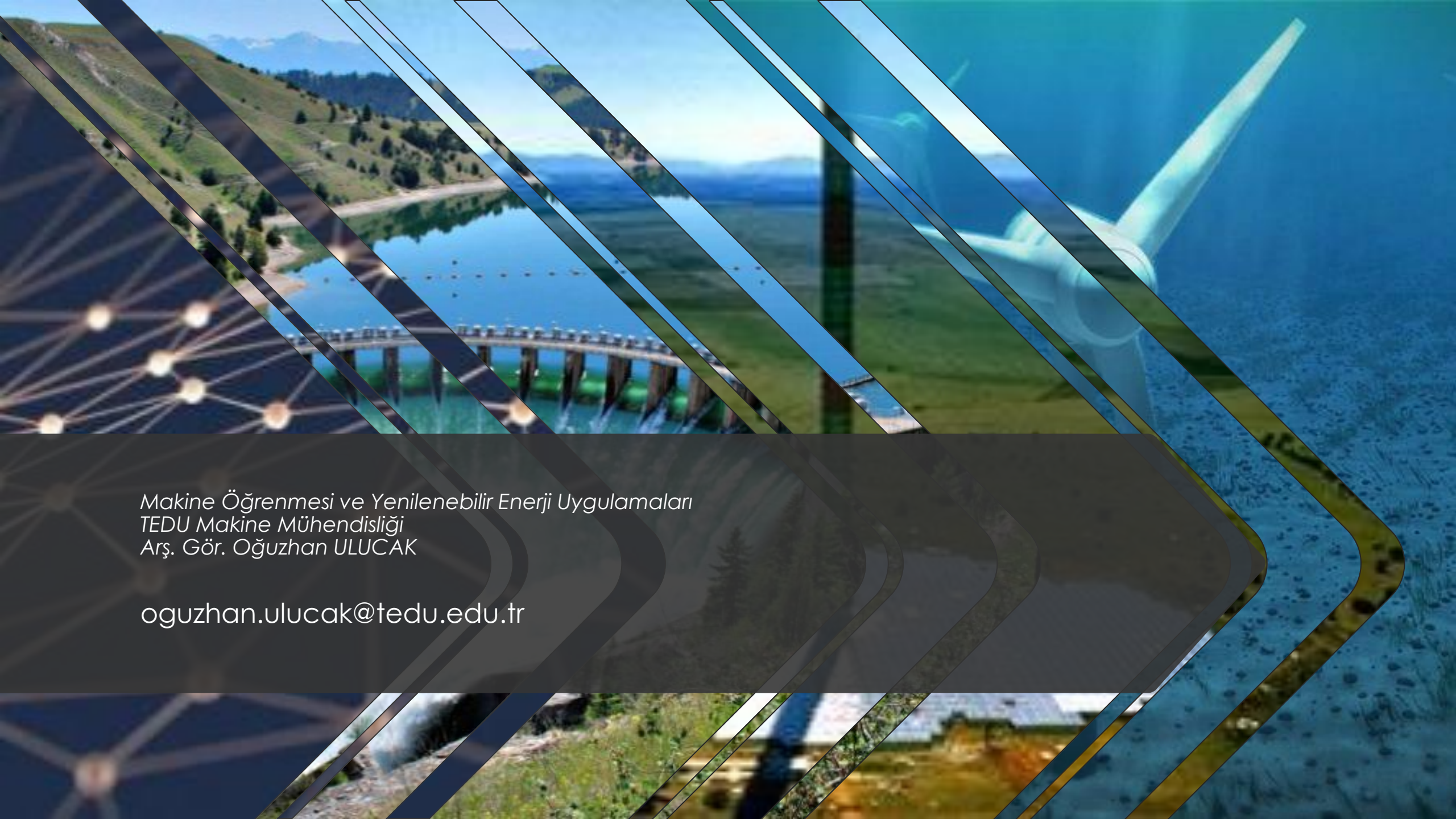
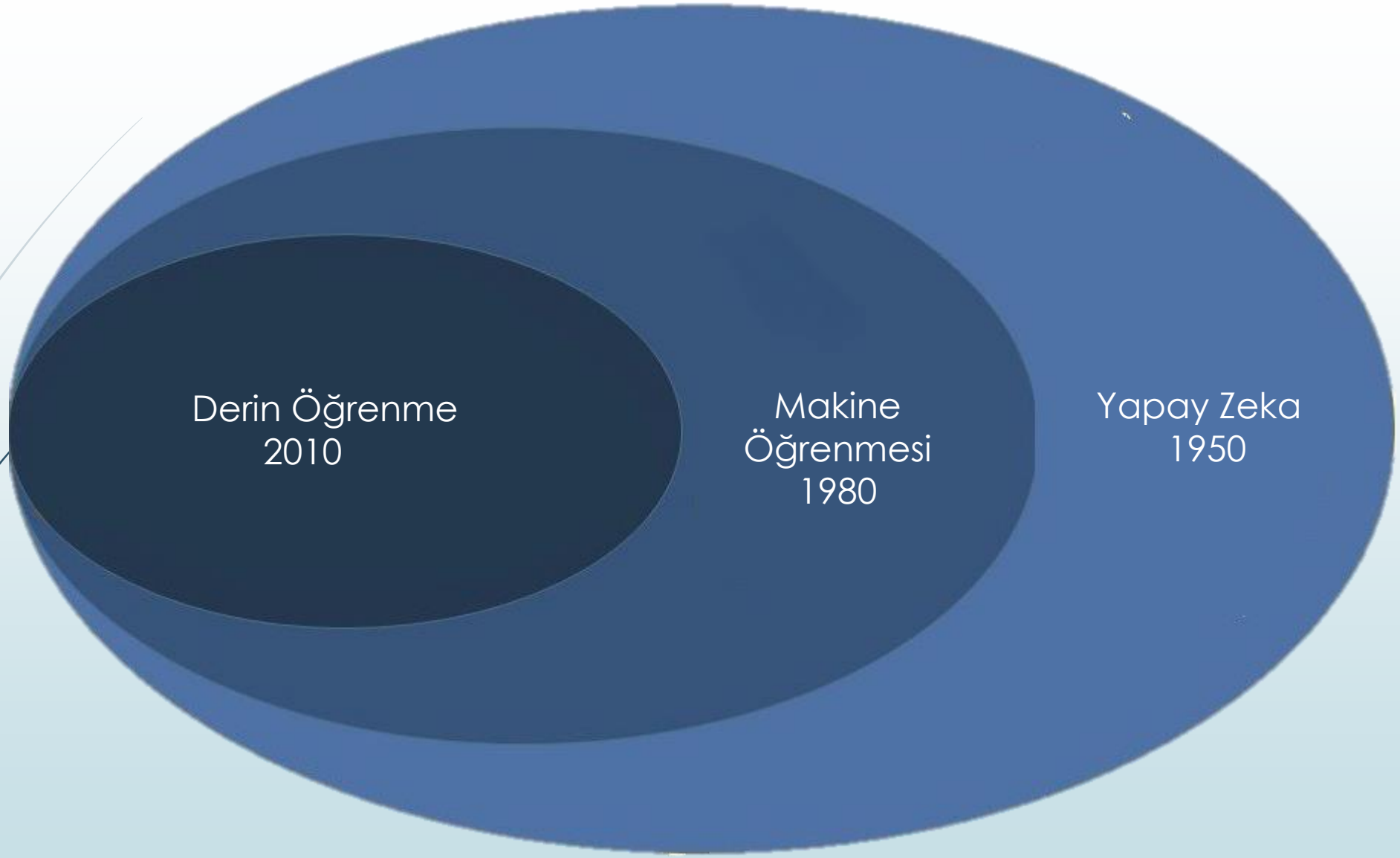
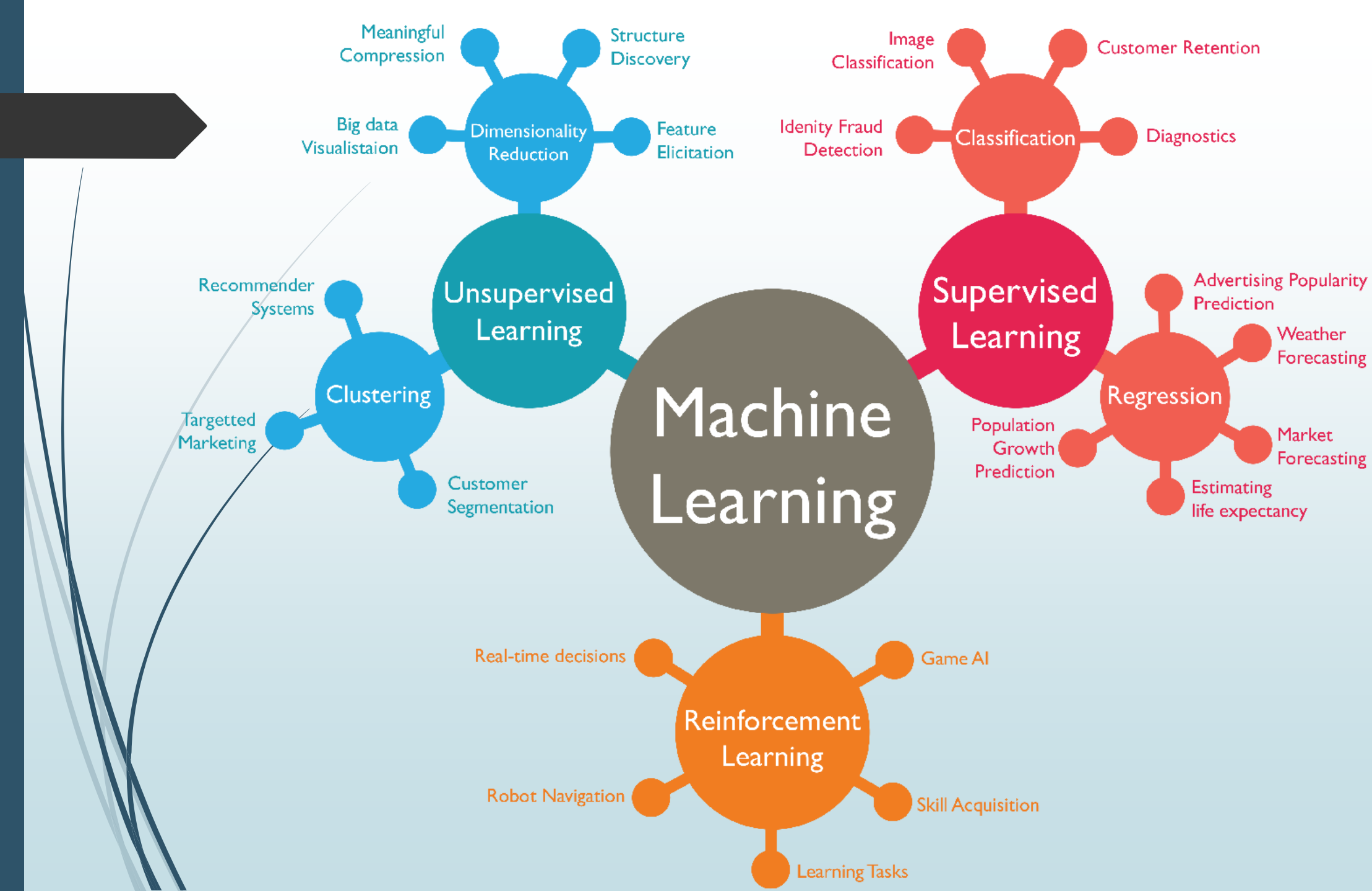


Makine Öğrenmesi ve Yenilenebilir Enerji Uygulamaları
TEDU Makine Mühendisliği
Arş. Gör. Oğuzhan ULUCAK

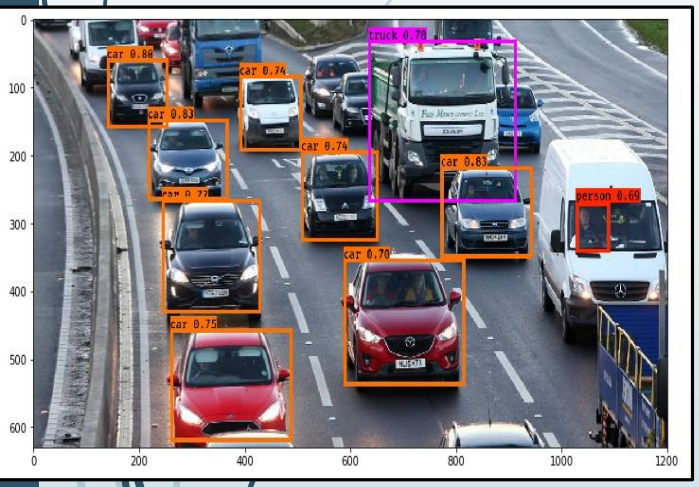
oguzhan.ulucak@tedu.edu.tr

Tarihsel Süreç

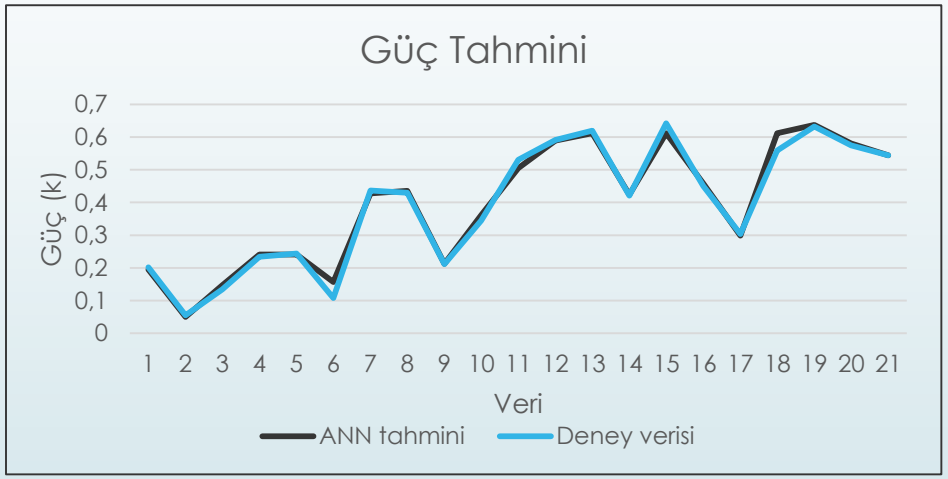



Machine Learning
Unsupervised Learning
Dimensionality Reduction
Meaningful Compression
Structure Discovery
Big data Visualistaion
Feature Elicitation
Clustering
Recommender Systems
Targetted Marketing
Customer Segmentation
Supervised Learning
Classification
Image Classification
Customer Retention
Idenity Fraud Detection
Diagnostics
Regression
Advertising Popularity Prediction
Weather Forecasting
Population Growth Prediction
Market Forecasting
Estimating life expectancy
Reinforcement Learning
Real-time decisions
Game AI
Robot Navigation
Skill Acquisition
Learning Tasks

Real-time decision

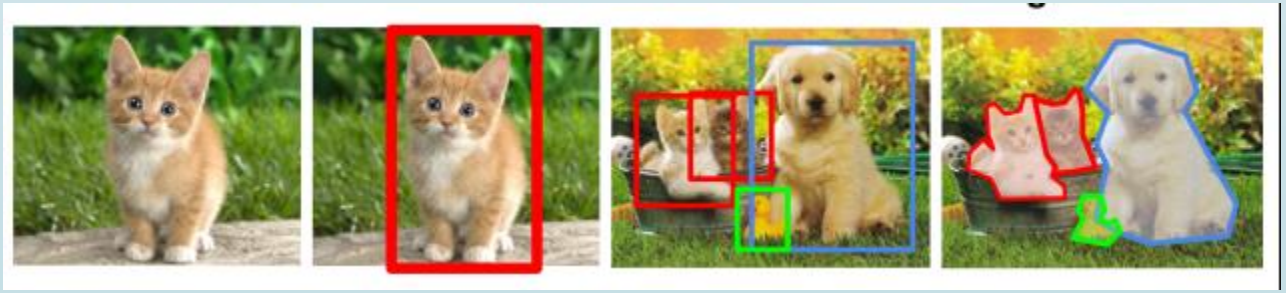


Prediction



Robot Navigation

İmage Classification



Veri

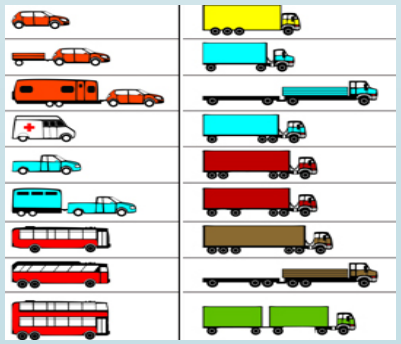
Veri

Veri İşleme

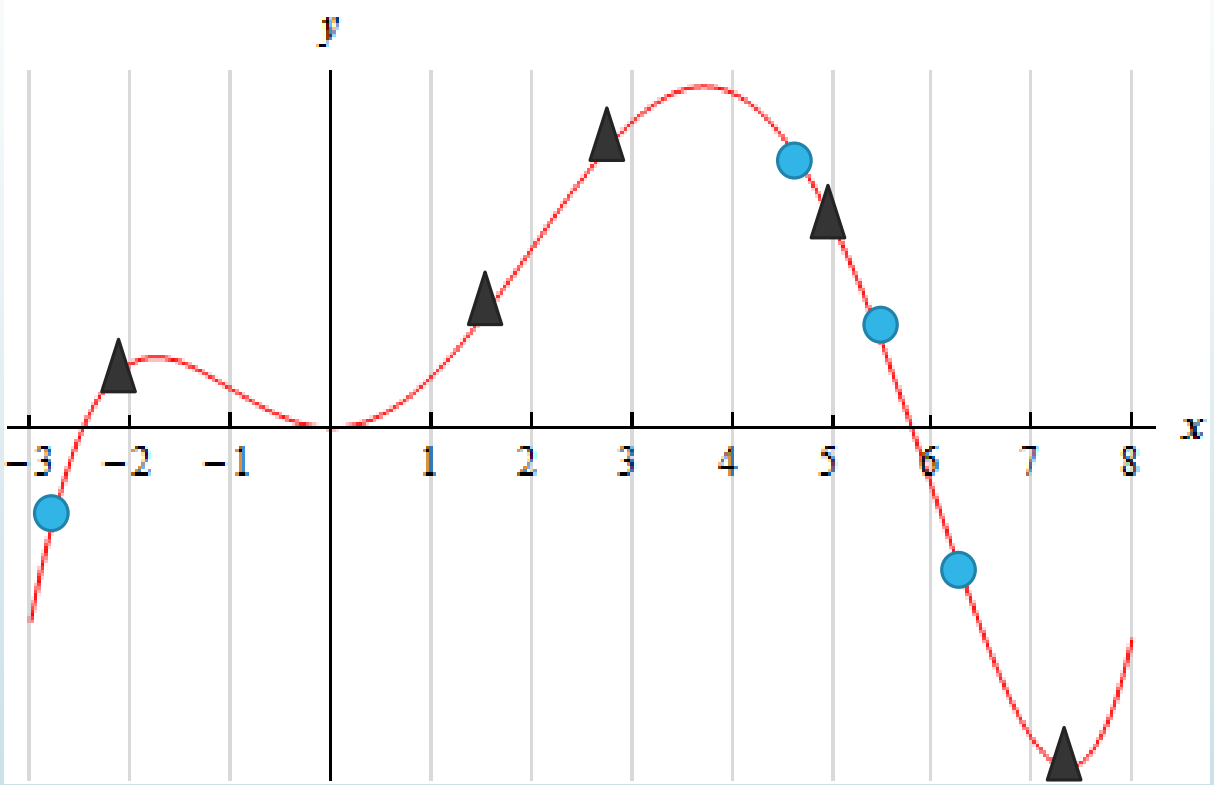
Eğitim

Model

-Tahmin
-Karar
-Sınıflandırma
-Tanı-Tespit

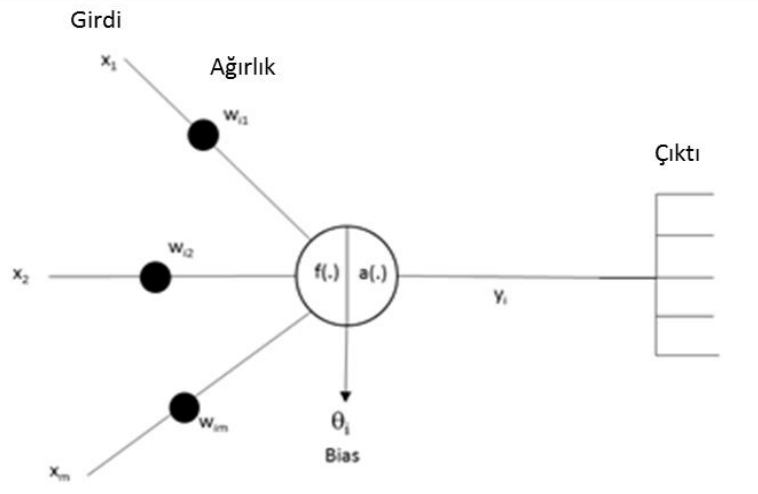


Mühendislik uygulamalarında amaç var olan veriler ışığında sistemin davranışını tespit veya tahmin etmek



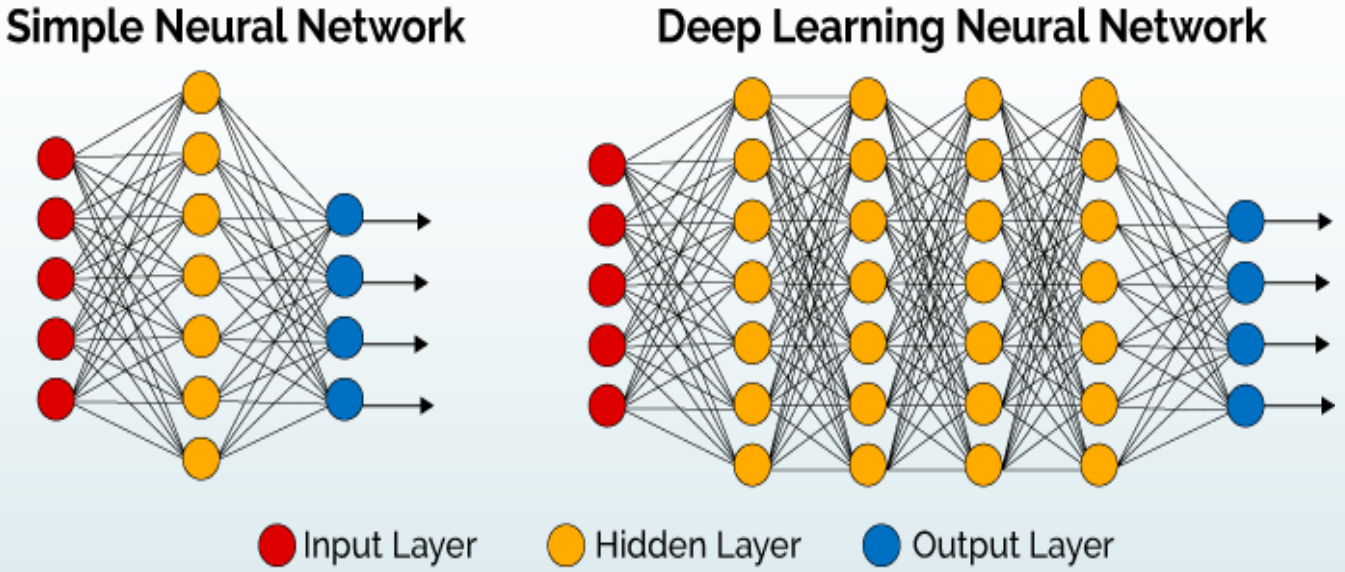
Bilinen Veriler

Bilinmeyenler



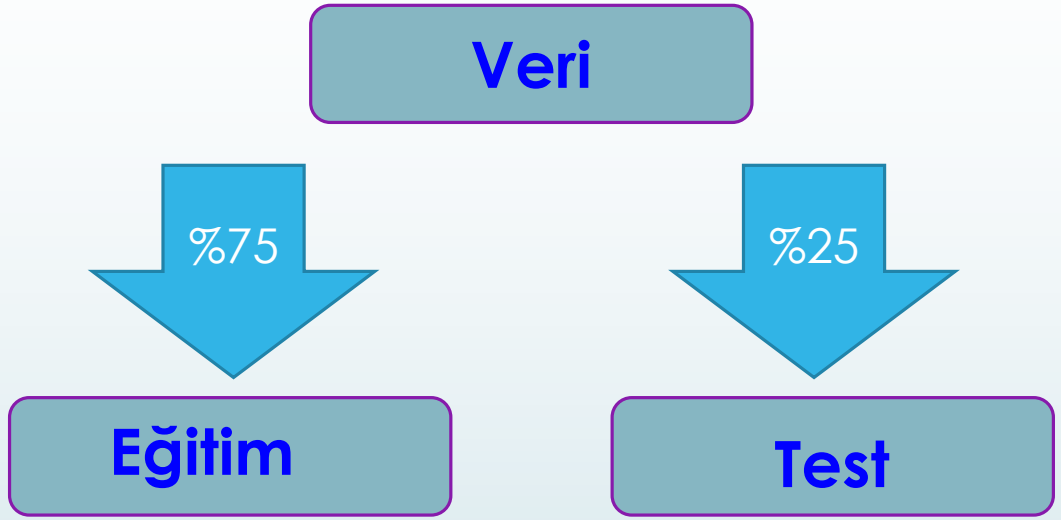
$$S_i = \sum_{i=1}^{n} w_{ij}\, x_i$$

x= Girdi
w= Ağırlık (Etki)
S= Çıktı



Nasıl Çalışır

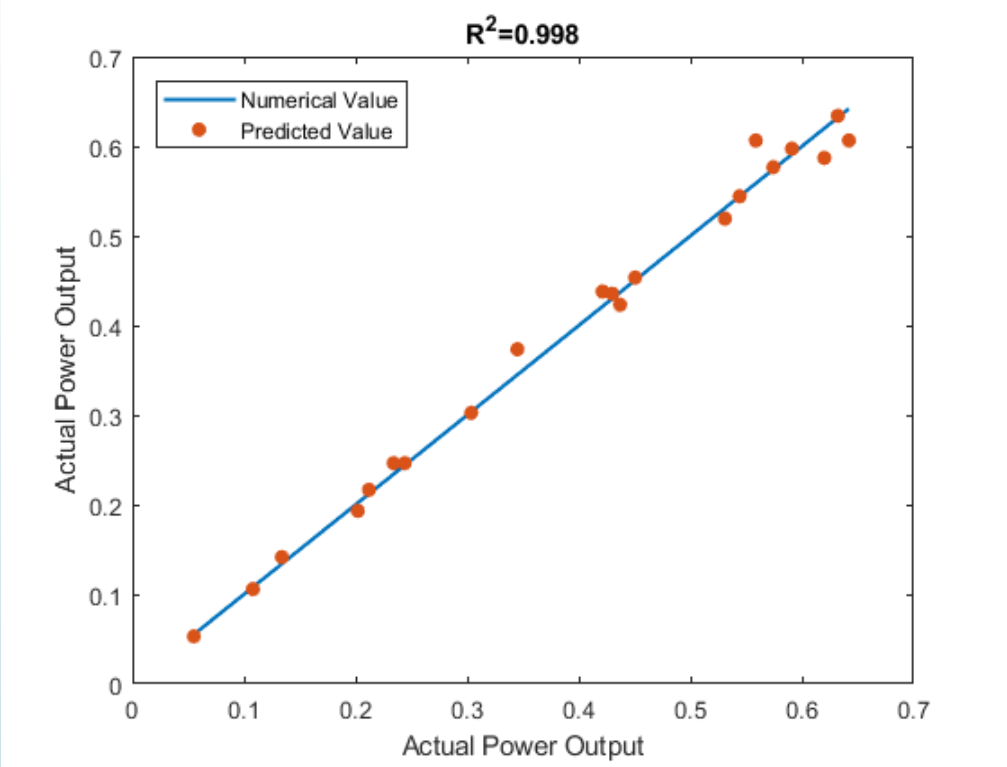
Hata Kriterleri



$$R^2 = 1 - \frac{\sum_i^N (X_{Gerçek,i} - X_{tahmin,i})^2}{\sum_i^N (X_{Gerçek,i})^2}$$

$$RMSE = \sqrt{\sum_{i=1}^{N} \frac{(X_{Gerçek,i} - X_{tahmin,i})^2}{N}}$$

$$OKH = \frac{1}{N} \frac{|X_{Gerçek,i} - X_{tahmin,i}|}{|X_{Gerçek,i}|}$$



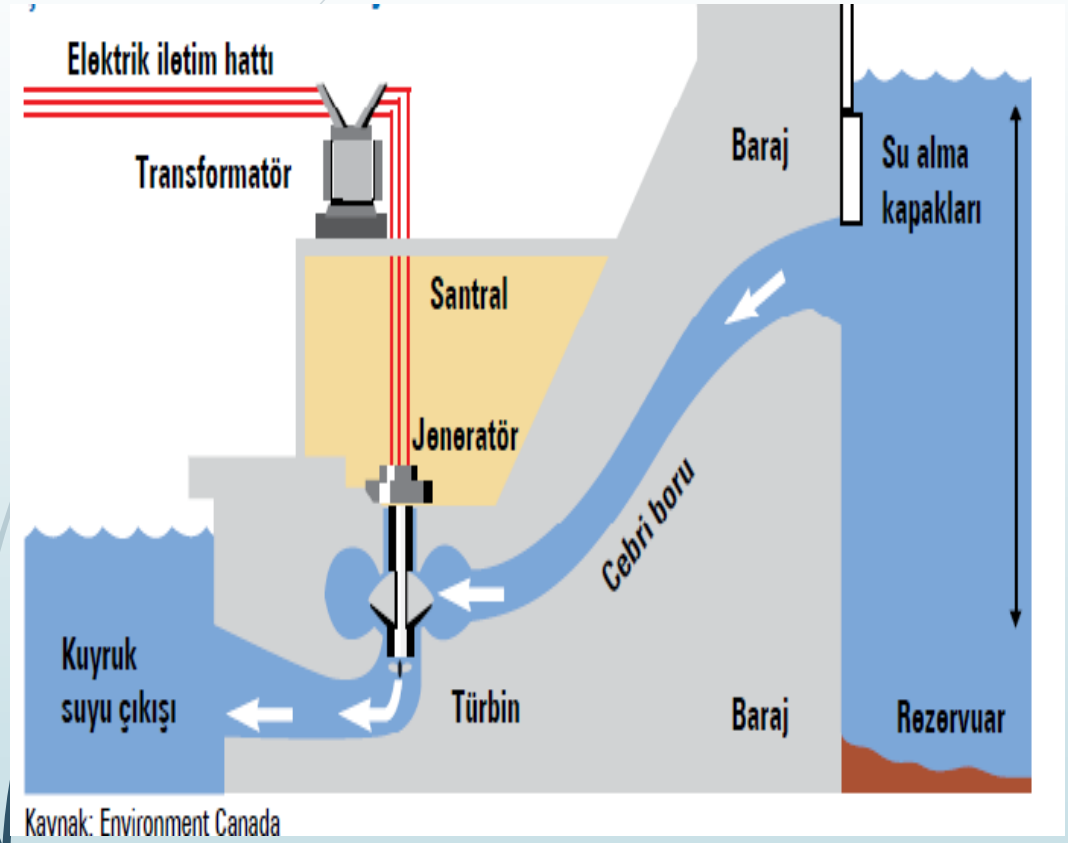
R-square: Girdilerin ortalamasına olan hataların toplamı

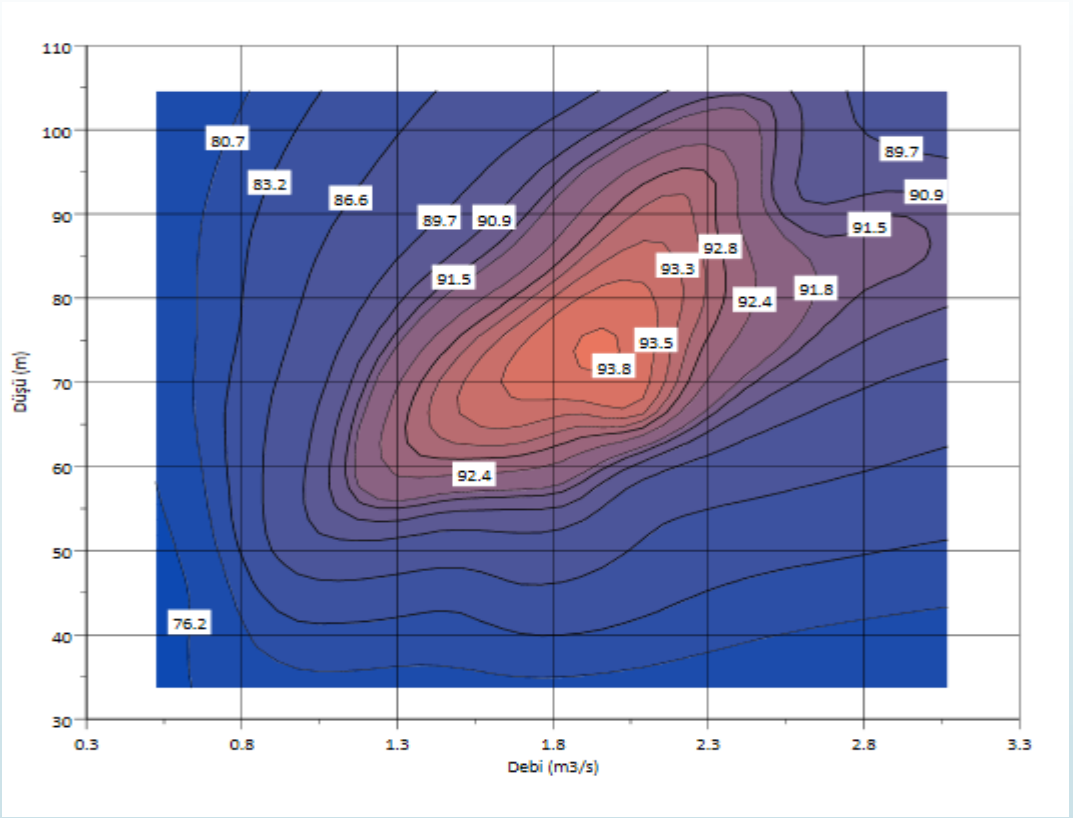
RMSE: Yapılan tahminin gerçek veriye olan uzaklığının ortalaması

OKH: Hataların ortalaması

Örnek: Buski HES

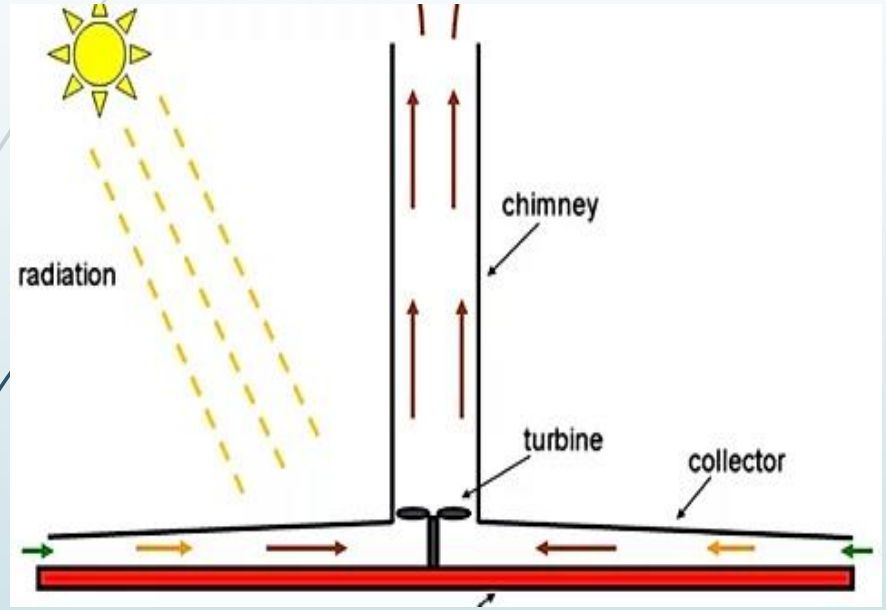
Girdiler = Debi, Düşü Çıktı= Verim



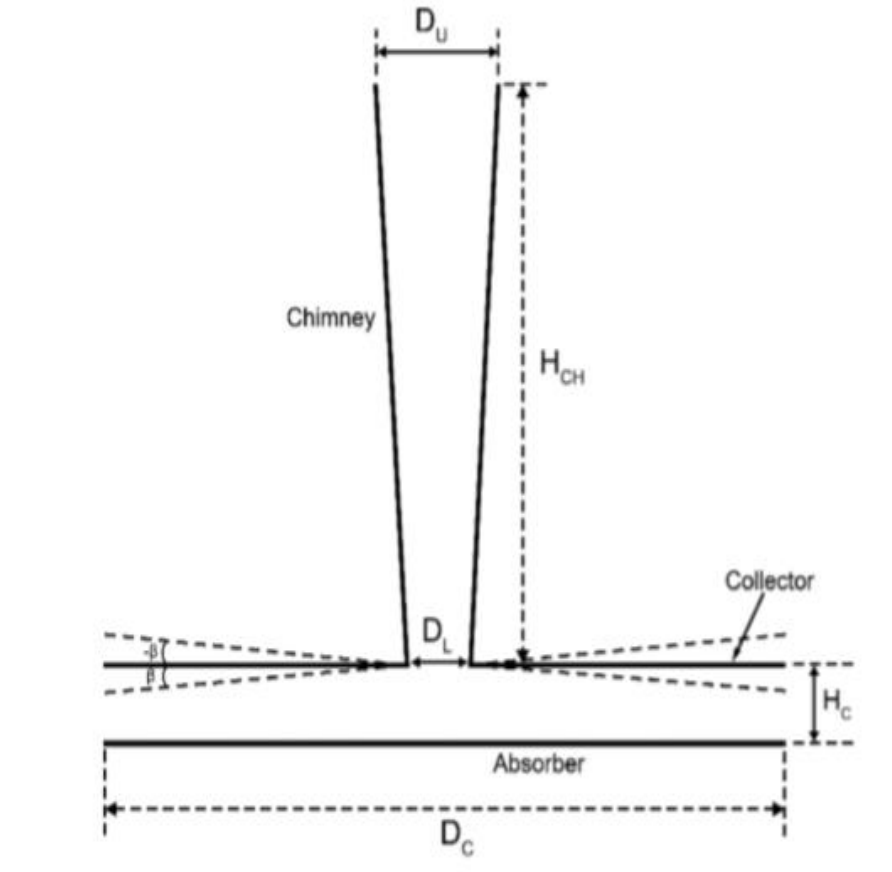


Ulucak, O., Ayli, E., ANN, and ANFIS Performance Prediction models for Francis type Turbines, Journal of Thermal Sciences and Technology, 2020

Örnek: Geometri Optimizasyonu- Yapay Sinir ağları Tasarımı

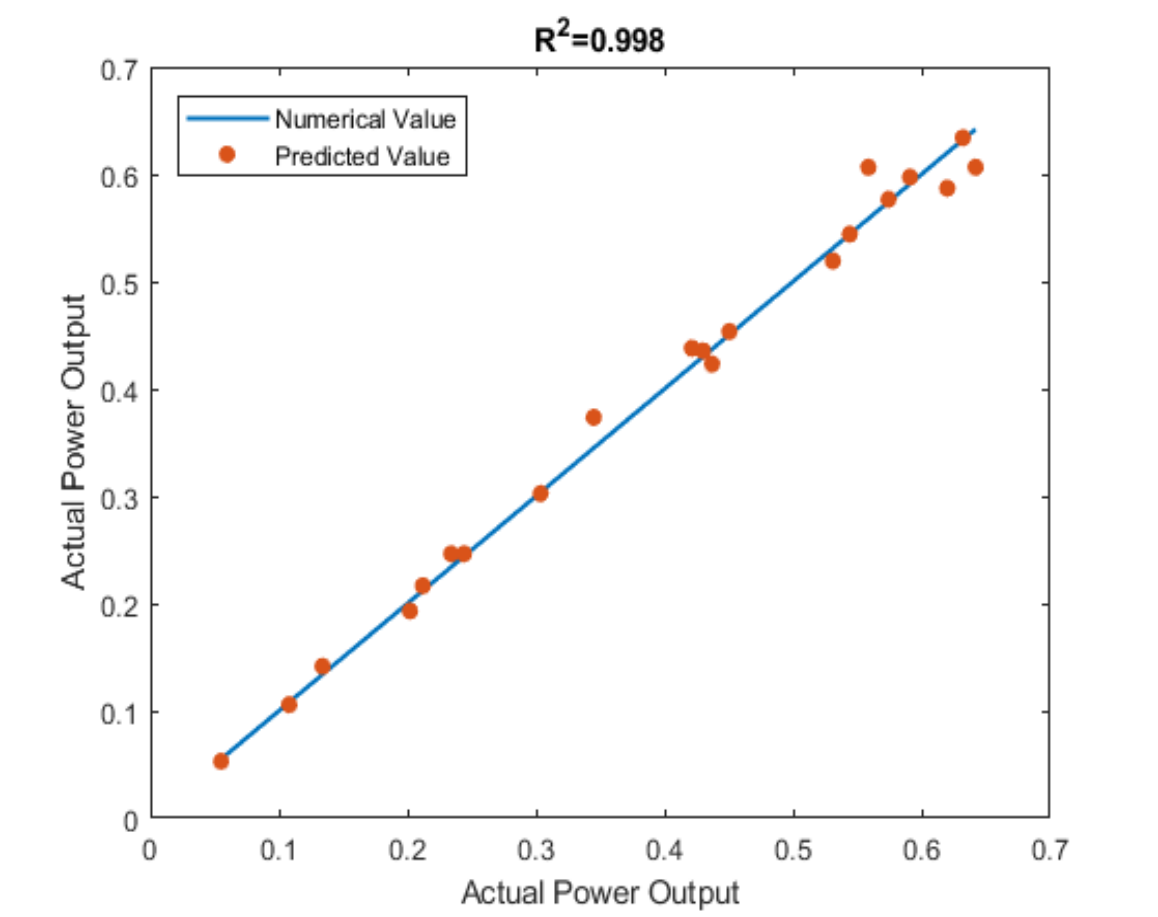


Veri-Eğitim



CFD/ Girdiler	Girdi						Güç
	Chimney			Collector			
	Kule Yüksekliği	Kule Girişi	Kule Çıkışı	Kollektör çapı	Kollektör genişliği	Meyil Açısı	
CFD 1	300	20	20	150	6	0	0.20
CFD 2	150	20	20	150	6	0	0.06
CFD 3	250	20	20	150	6	0	0.13
CFD 4	350	20	20	150	6	0	0.23
CFD 5	350	20	20	150	6	0	0.24
CFD 6	350	15	15	150	6	0	0.11
CFD 7	350	25	25	150	6	0	0.44
CFD 8	350	35	35	150	6	0	0.43
CFD 9	350	25	35	100	6	0	0.21
CFD 10	350	25	35	125	6	0	0.35
CFD 11	350	25	35	150	6	0	0.53
CFD 12	350	25	35	175	6	0	0.59
CFD 13	350	25	35	200	5	0	0.62
CFD 14	350	25	35	200	4	0	0.42
CFD 15	350	25	35	200	6	0	0.64
CFD 16	350	25	35	200	8	0	0.45
CFD 17	350	25	35	200	10	0	0.30
CFD 18	350	25	35	200	6	0	0.56
CFD 19	350	25	35	200	6	0.5	0.63
CFD 20	350	25	35	200	6	-0.5	0.57
CFD 21	350	25	35	200	6	-1	0.54

Eğitim doğrulaması



Güç(p1,p2,p3,p4, p5, p6)=Tanımlı

Optimizasyon Metodu

P1						
1. Girdi	2. Girdi (Ortalama)	3. Girdi (Ortalama)	4. Girdi (Ortalama)	5. Girdi (Ortalama)	6. Girdi (Ortalama)	121 x 6 matrix
500	Sabit	Sabit	Sabit	Sabit	Sabit	
503	Sabit	Sabit	Sabit	Sabit	Sabit	
506	Sabit	Sabit	Sabit	Sabit	Sabit	
…	…	…	…	…	…	
…	…	…	…	…	…	
4997	Sabit	Sabit	Sabit	Sabit	Sabit	
4500	Sabit	Sabit	Sabit	Sabit	Sabit	

$$P_{1,\,Optimum} = Power_{\,Maximum}\,(P_{2,\,Ortalama}, P_{3,\,Ortalama}, P_{4,\,Ortalama}, P_{5,\,Ortalama}, P_{6,\,Ortalama})$$

$$P_{2,\,Optimum} = Power_{\,Maximum}\,(P_{1,\,optimum}, P_{3,\,Ortalama}, P_{4,\,Ortalama}, P_{5,\,Ortalama}, P_{6,\,Ortalama})$$

$$P_{3,\,Optimum} = Power_{\,Maximum}\,(P_{1,\,optimum}, P_{2,\,optimum}, P_{4,\,Ortalama}, P_{5,\,Ortalama}, P_{6,\,Ortalama})$$

$$P_{4,\,Optimum} = Power_{\,Maximum}\,(P_{1,\,optimum}, P_{2,\,optimum}, P_{3,\,optimum}, P_{5,\,Ortalama}, P_{6,\,Ortalama})$$

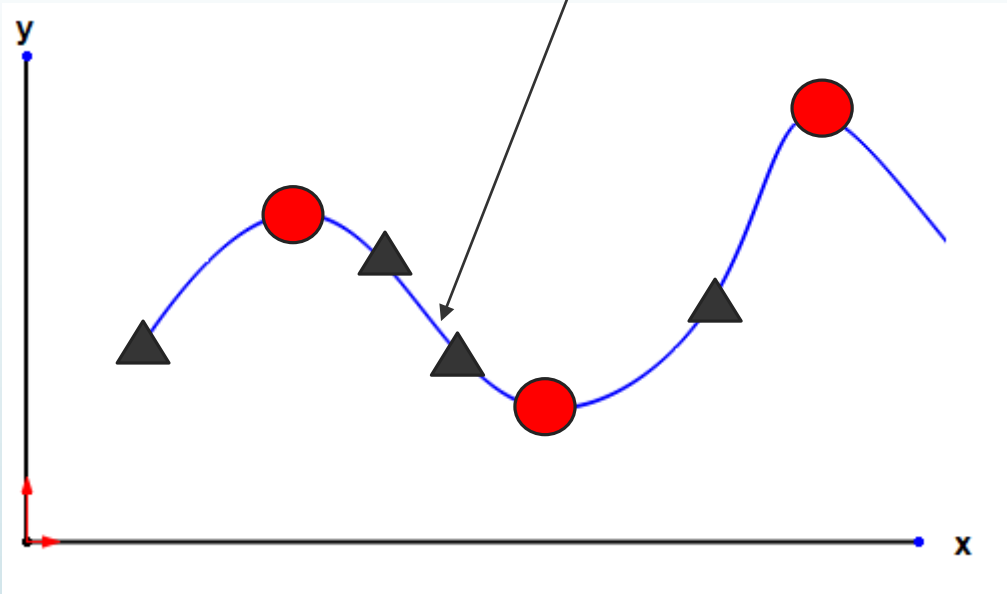
$$P_{5,\,Optimum} = Power_{\,Maximum}\,(P_{1,\,optimum}, P_{2,\,optimum}, P_{3,\,optimum}, P_{4,\,optimum}, P_{6,\,Ortalama})$$

$$P_{6,\,Optimum} = Power_{\,Maximum}\,(P_{1,\,optimum}, P_{2,\,optimum}, P_{3,\,optimum}, P_{4,\,optimum}, P_{6,\,optimum})$$

$$\boldsymbol{P_{\,Optimum} = Power_{\,Maximum}\,(P_{1,\,optimum}, P_{2,\,optimum}, P_{3,\,optimum}, P_{4,\,optimum}, P_{5,\,optimum}, P_{6,\,optimum})}$$

Sistemin Çıkışı

Sistemin Davranışı
(Ör: Güç)



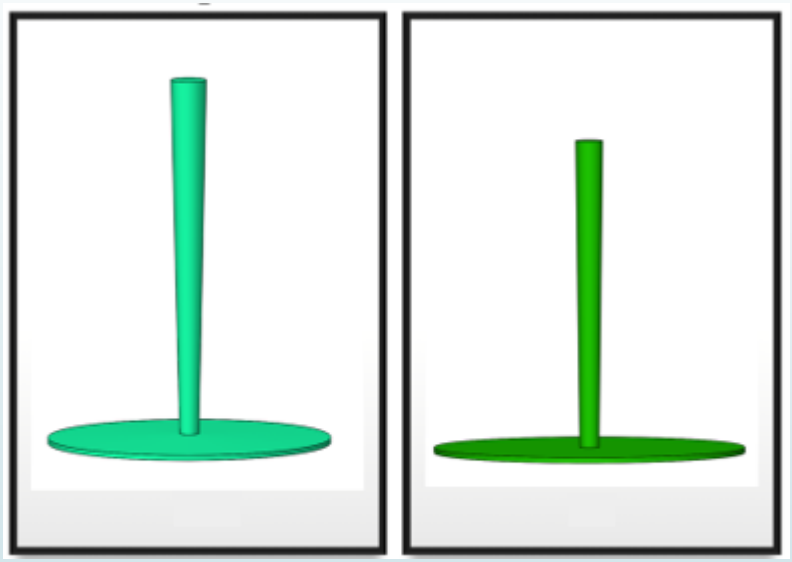
Bilinen Noktalar
(Deney,
Fonksiyon)

Yakalanmak
istenen
Maksimum değer

Sistemin Parametresi

721 Adet Farklı Tasarım içinden seçilen optimum geometri

+ %14.1 Güç



ANN model CFD model

- Image Processing
- Edge Detection
- Big Data
- Web Scrapping
- Data Mining
- Genetic Algorithm