

II. Karmaşık Sistemler ve Veri Bilimi Çalıştayı

4 Mayıs 2019, Cumartesi, 09:10-16:30, Boğaziçi Üniversitesi
Kuzey Kampüsü, Bilgisayar Müh. Binası, A2 Sınıfı

Çalıştay programı ve kayıt için:
[Bit.ly/kave2019](https://bit.ly/kave2019)



Istanbul Bilgi Üniversitesi
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How to Combine Complex Systems and Data Science ?

Uzay Çetin
Istanbul Bilgi University

KaHVE

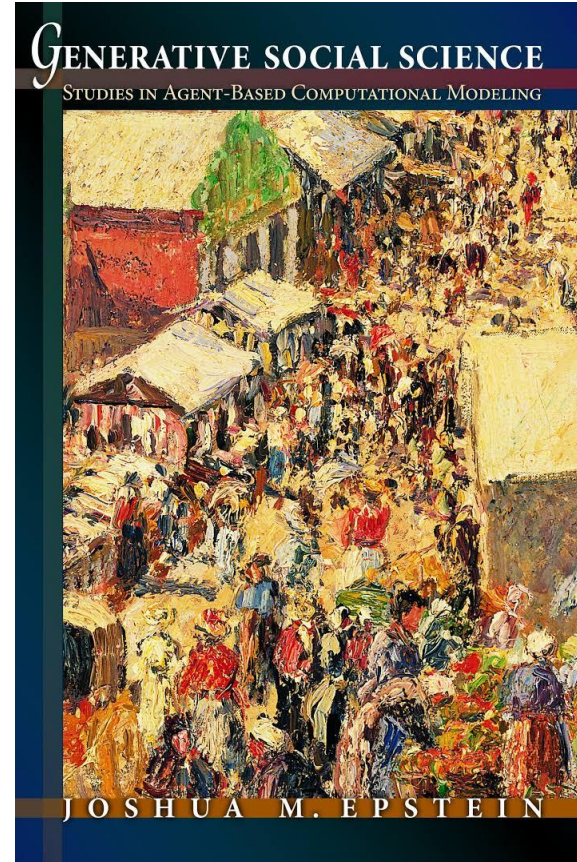
<https://uzay00.github.io/kahve/>

Complex Systems

More is different !!

- One water molecule is not fluid
- One neuron is not intelligent
- One amino acid is not alive

What makes the difference?

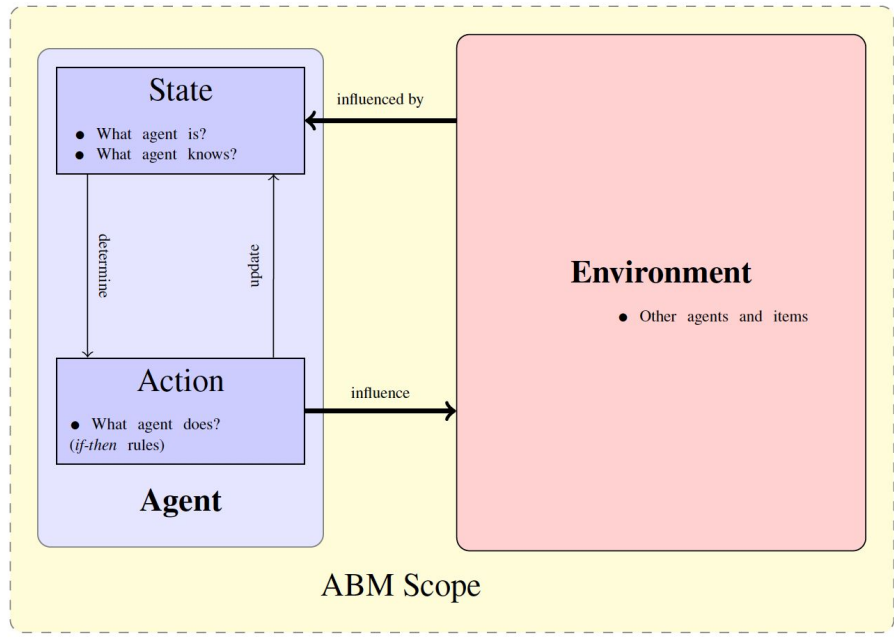


An Agent

is an *autonomous* computational unit

Relationships are primary, agents are secondary!!

Structure Generates Behavior!!



Data Science → Complex Systems

- Model parameters of a Complex System can be determined by analysing data
- Complex Systems generates huge amount of data to be analysed.

Complex Systems → Data Science

- Agent based models can be transformed to optimisation algorithms to be used in classical machine learning problems.
- Complex network analysis help a lot to analyse graph data.

Research Question I

- How to improve **improve** the capabilities of **agent-based models** in order to use them for **prediction** just like the standard **machine learning** algorithms?

Research Question II

- What can **Complex Network** analysis bring and **offer** to text mining, **sentiment analysis** and **data curation**?

Murat Can Ganiz (Marmara Uni.)

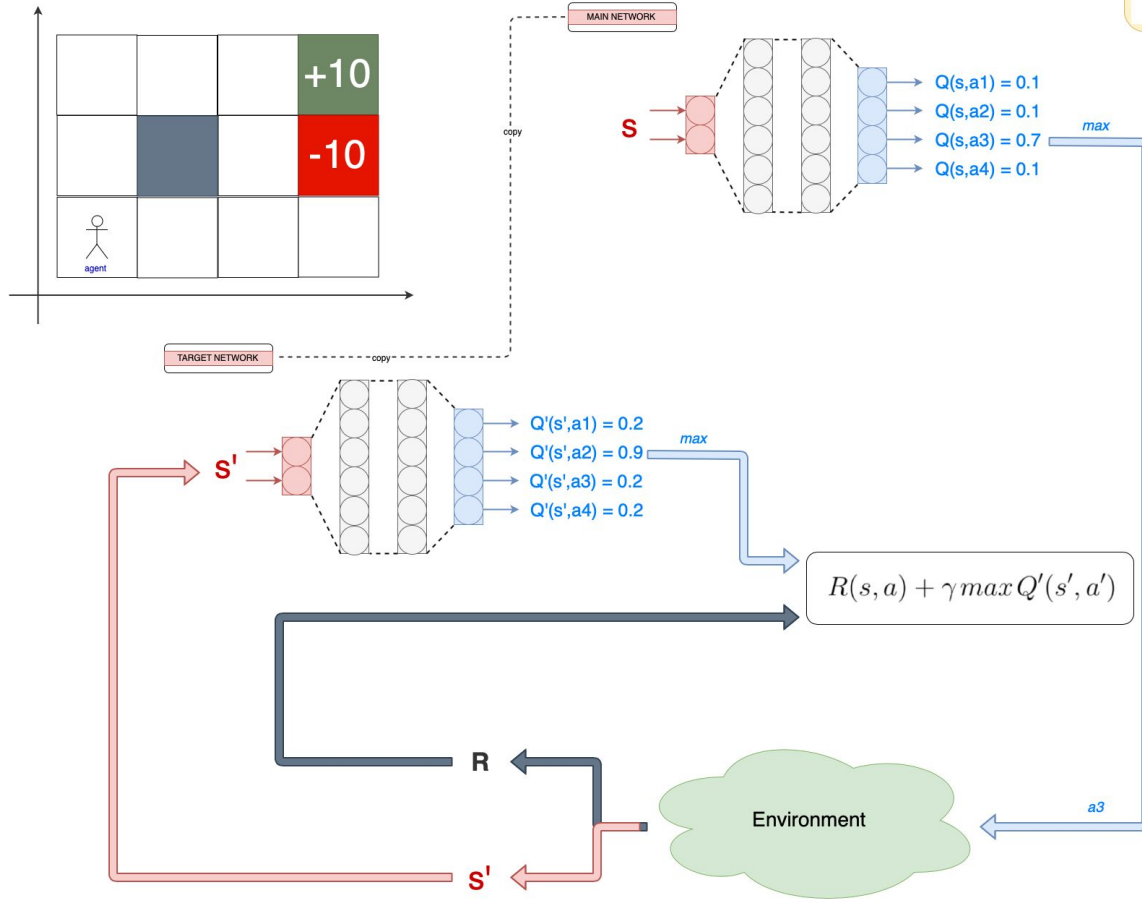
13.25 - 13.45 Complex Networks meet Deep Learning:
Graph Convolutional Networks

Deep Learning Revolution

*Neural Networks are universal **function approximators !!***

- ...
- Deep RL, created by DeepMind, 2013 @Google,
- GANs, created by Ian GoodFellow, 2014 @Google
- ...

Deep Reinforcement Learning Agent



Bellman Equation

$$Q(s, a) = R(s, a) + \gamma \max_{a'} Q'(s', a')$$

$$Q(s, a) \Rightarrow \text{Prediction} = 0.7$$

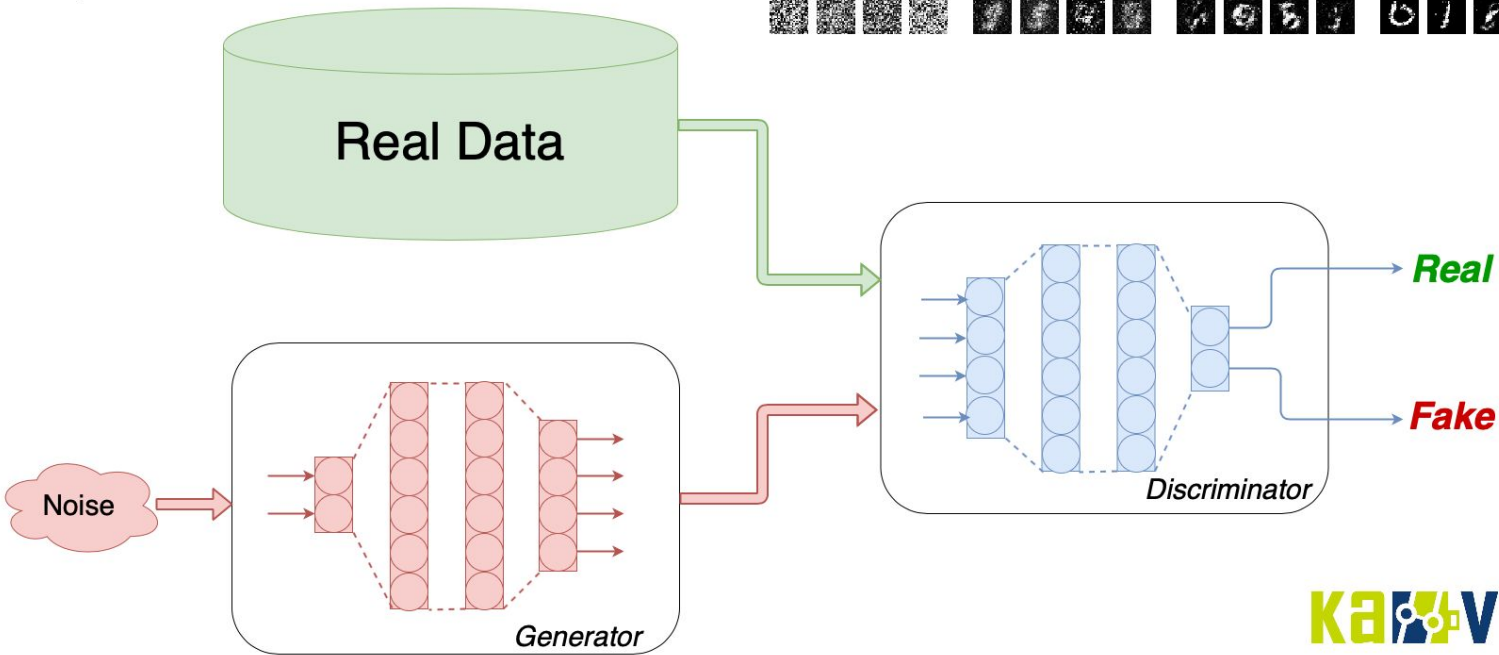
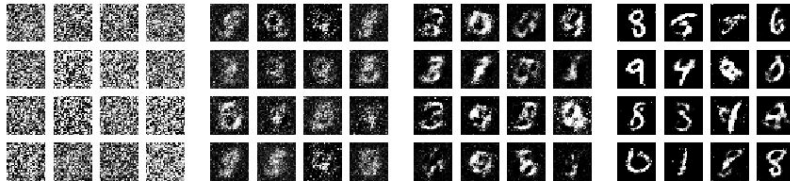
$$MSE = \sum_s (Prediction - Target)^2$$

$$R = 0, \gamma = 1 \Rightarrow \text{Target} = 0.9$$

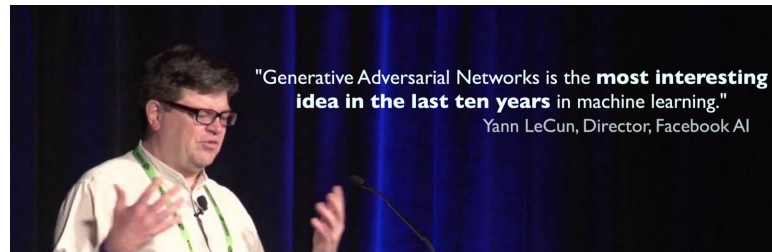
`model.fit(S , [0.1, 0.1, 0.9, 0.1])`

Generative Adversarial Networks

2 Player Game



Karve



Deep Learning Revolution

*Neural Networks are universal **function approximators** !!*

- ...
- Deep RL, created by DeepMind, 2013 @Google,
 - **One Deep Learning Agent**
- GANs, created by Ian GoodFellow, 2014 @Google
 - **Two Deep Learning Agents**
- ...

Question From Complexity Science

*What if we create a simulation of **multiple Deep Learning Agents** !!*

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Thank You

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