# Dinamiche su network

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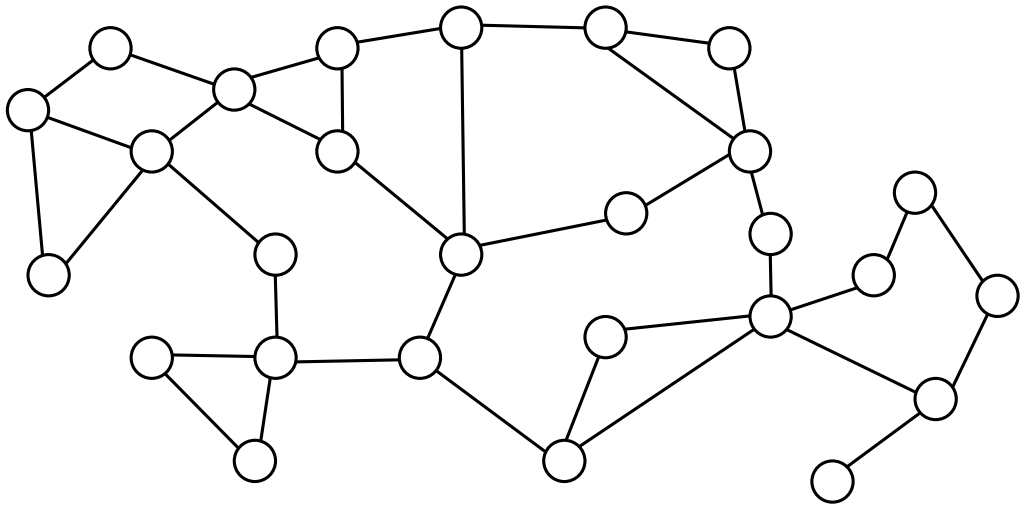
# The core of these lectures

Interacting multi-agent systems evolving over time

The ingredients:

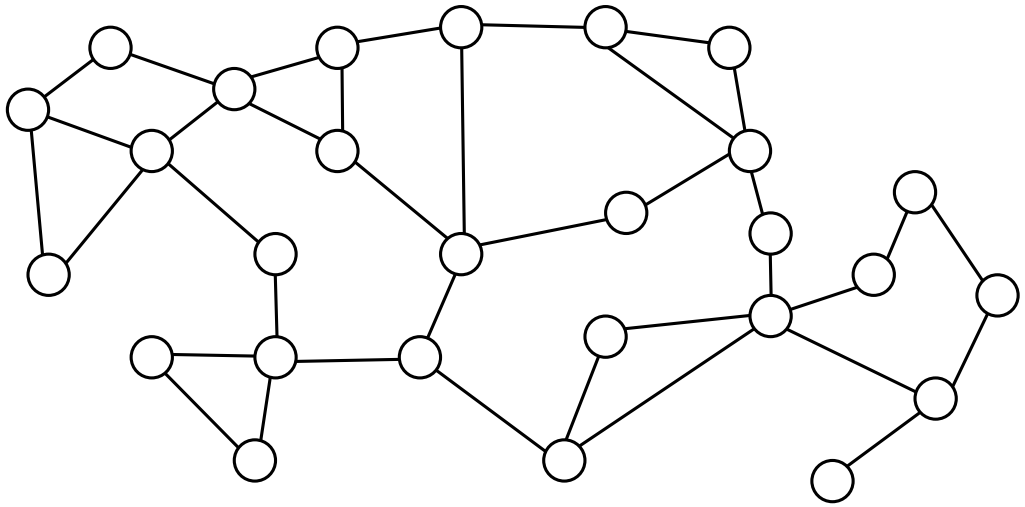
- a network of interactions
- local rules specifying the evolution



# The core of these lectures

Flow dynamics through an infrastructure network:

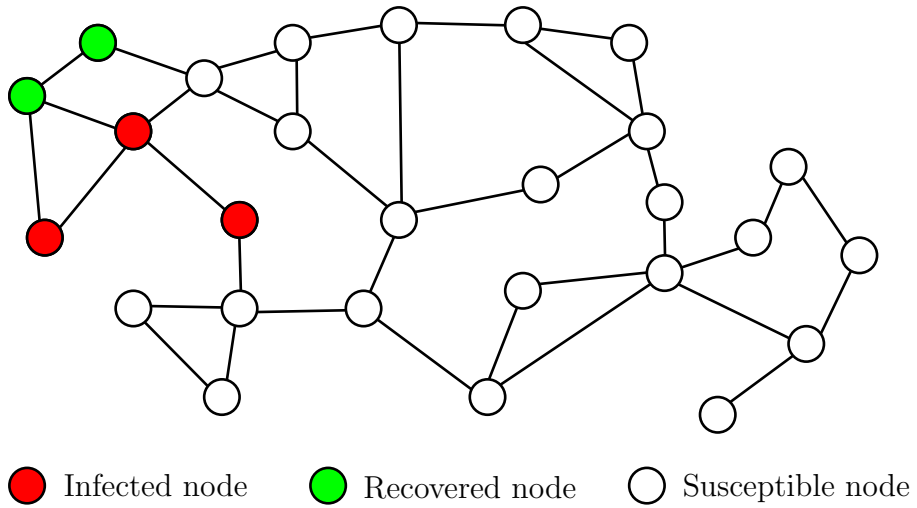
- road networks, power grids, markets
- forecast behavior
- optimization and control
- resilience to shocks, cascading failures



# The core of these lectures

Spread of epidemics:

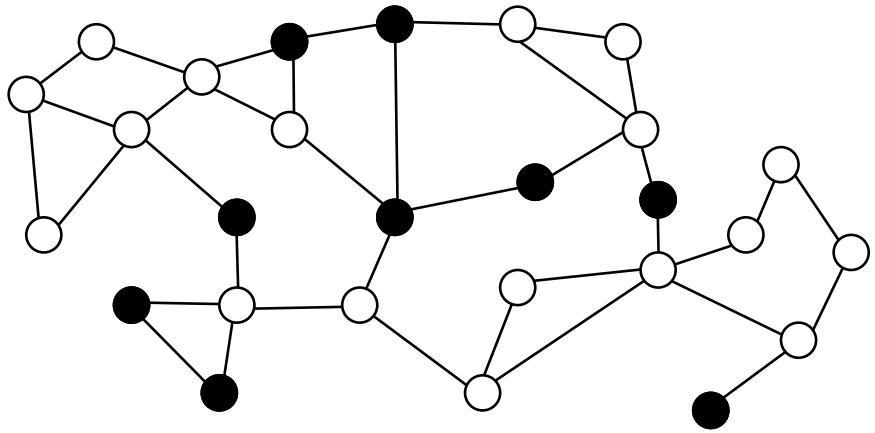
- forecast the diffusion of the epidemics
- effect of lockdown, distantiation
- modeling individual behavior



# The core of these lectures

Opinion evolution over social networks:

- fusion and diffusion of infomation
- spread of rumors, fake news

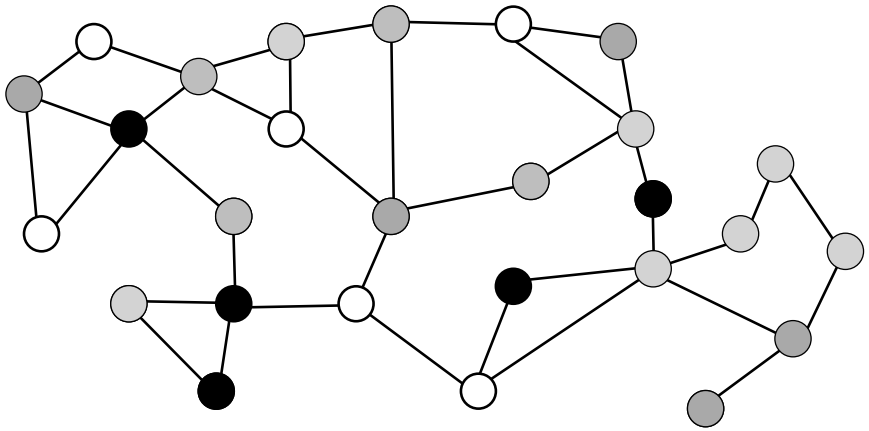


Individuals with different opinions

# The core of these lectures

Opinion evolution over social networks:

- fusion and diffusion of infomation
- wisdom of crowds

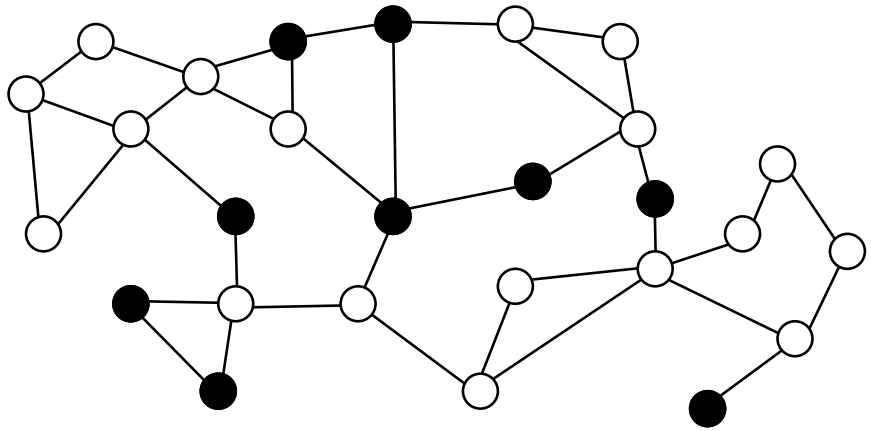


Opinions with a continuous range of values

# The core of these lectures

Spread of new ideas, adoption of new technologies

- imitation mechanisms, threshold behavior
- marketing strategies

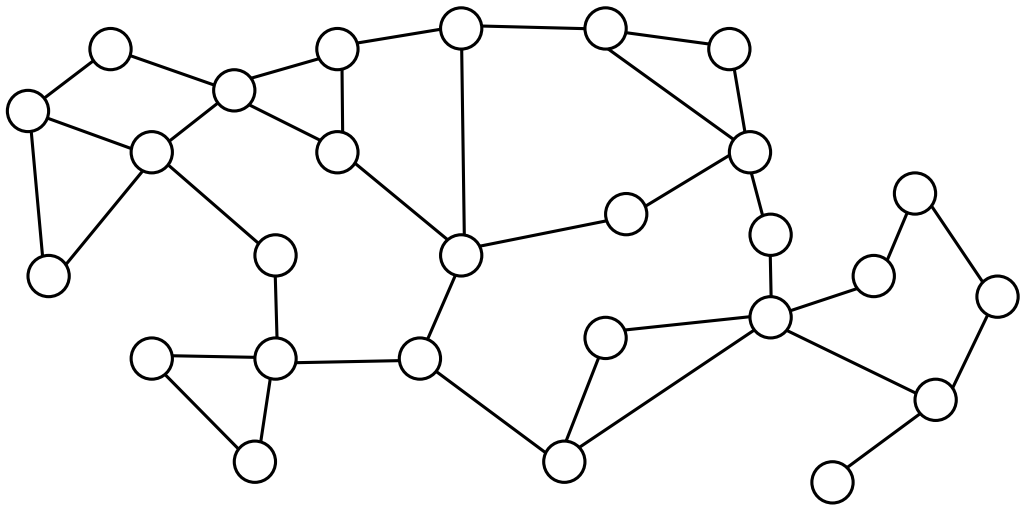


Individuals who have bought a certain good

# The core of these lectures

Distributed algorithms:

- nodes are (virtual) computational elements
- law complexity algorithms
- optimization problems in AI



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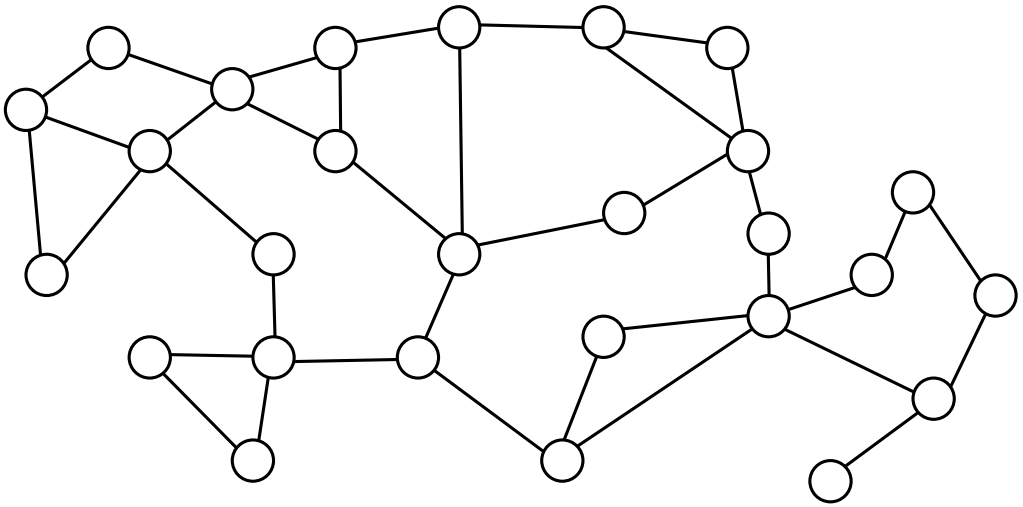
Interacting multi-agent systems evolving over time



Network topology
Local specifications
$\rightarrow$ Global emerging behavior

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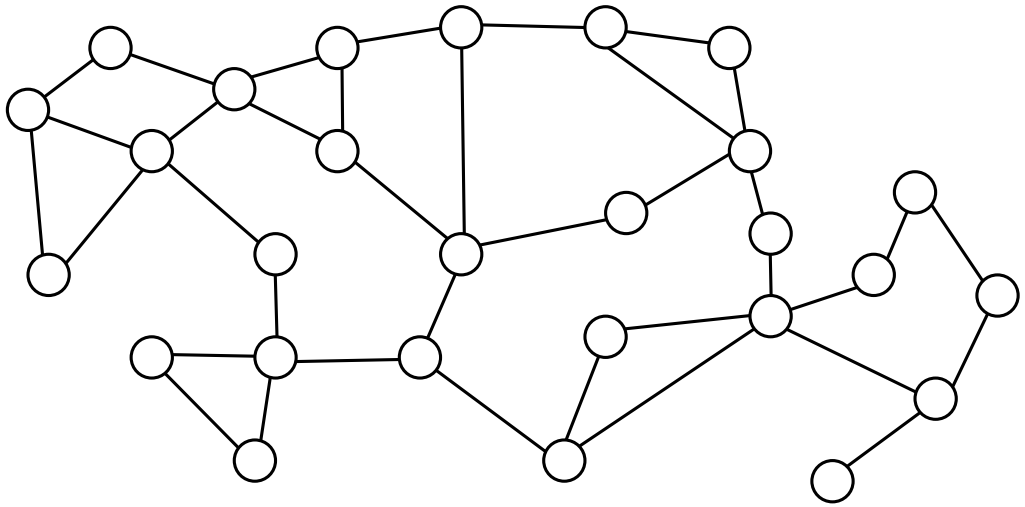
Interacting multi-agent systems evolving over time



Network topology
Local specifications
$\rightarrow$ Global emerging behavior

Nodes are simple. Complexity comes from the network!

# Summary

- Elements of graph theory
- Averaging and flow dynamics over a graph
- Markov processes
- Epidemic models
- Models from game theory
- Distributed algorithms
- Random graph models