

Variety Dynamics in Operational Research

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Modelling and simulation in Operational Research

Classic approaches to Operational Research include:

- Combinatoric reasoning
- Queuing theory
- Linear programming
- Discrete event modelling
- Critical path analyses
- Network optimization
- Assignment problems
- Problem structuring
- Systems methods
- Bayesian and other search
- Scheduling
- Stakeholder approaches
- Robustness and sensitivity analyses
- Cognitive mapping
- Inventory control
- Goal modelling
- Sequencing theories
- Dynamic programming
- Markov
- PERT
- Information Theories
- Business process Modelling
- UML

Characteristics of Operational Research

- Scientific
- Uses mathematics
- Focuses on whole systems
- Provides support for people making decisions about complex issues
- ...

Benefits of Operational Research

- Benefits include:
- Enhanced productivity
 - System being managed
 - Managers using Operational Research
- Improved coordination between disparate systems
- Lower risks of failures
- Improved system control

Other sides to Operational Research

- Expensive in time and resources
- Depends on experts and technology
- Difficult for managers to check correctness of OR
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Analytical structures of OR analyses and modeling

The general structure of OR methods is founded on:

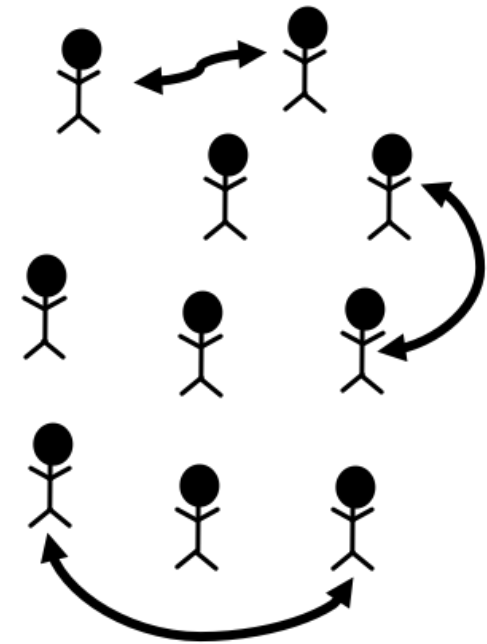
- Elements and systems of linked elements
- Relationships between elements
- Behaviour of elements over time
- Events
- Stakeholder understanding of element behavior, relationships problems and outcomes

Example:
Agent-based
modeling 1

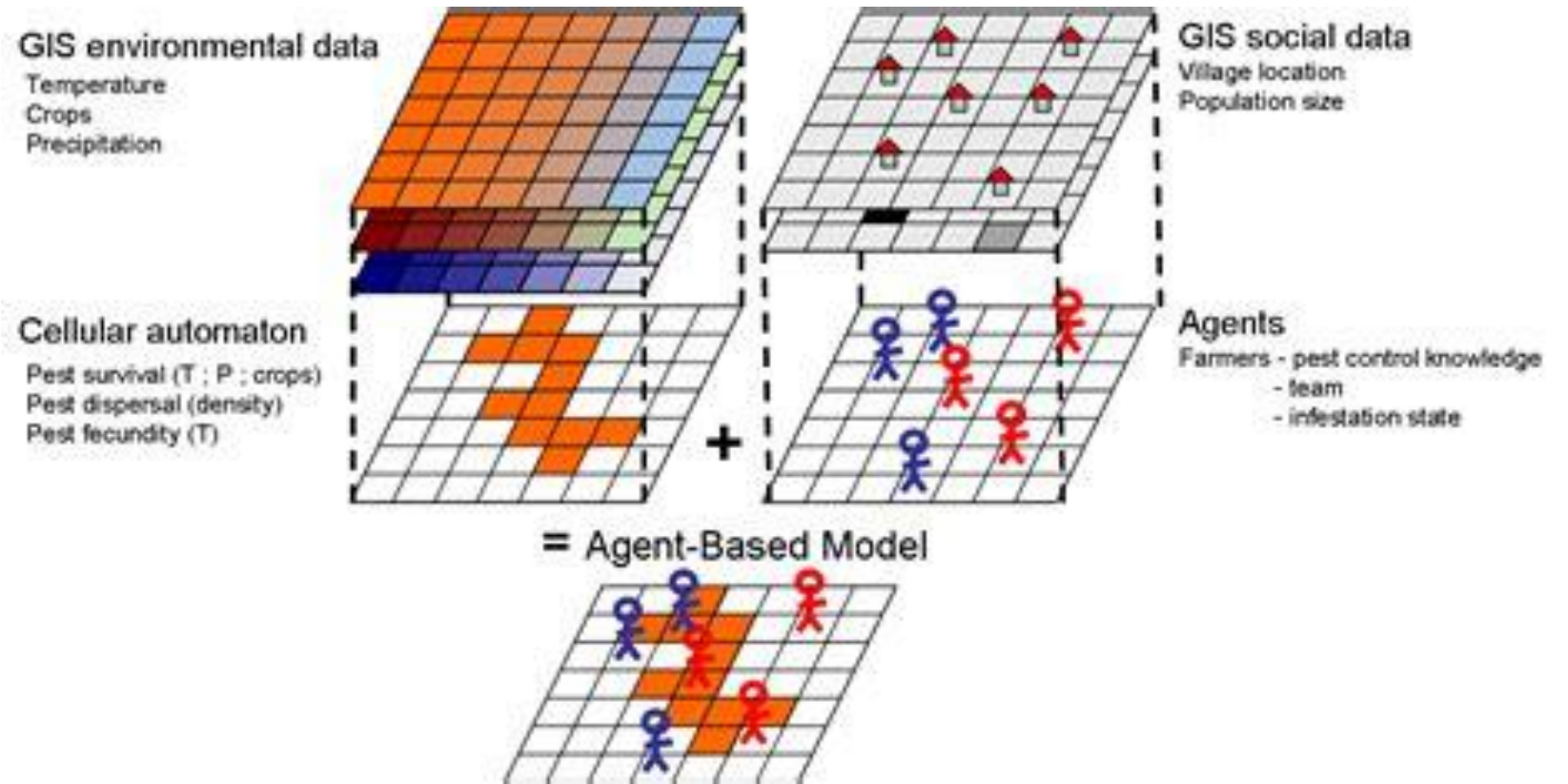
Real world



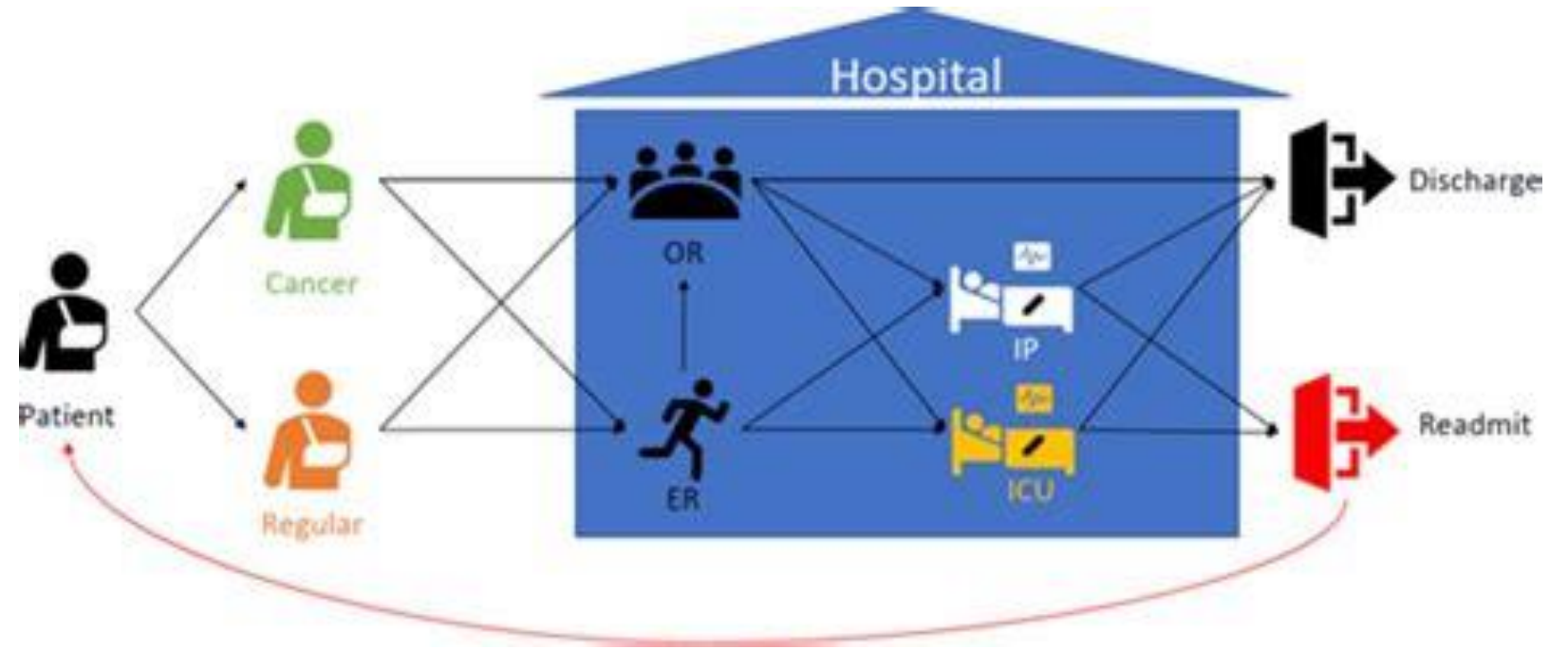
Agent-based model



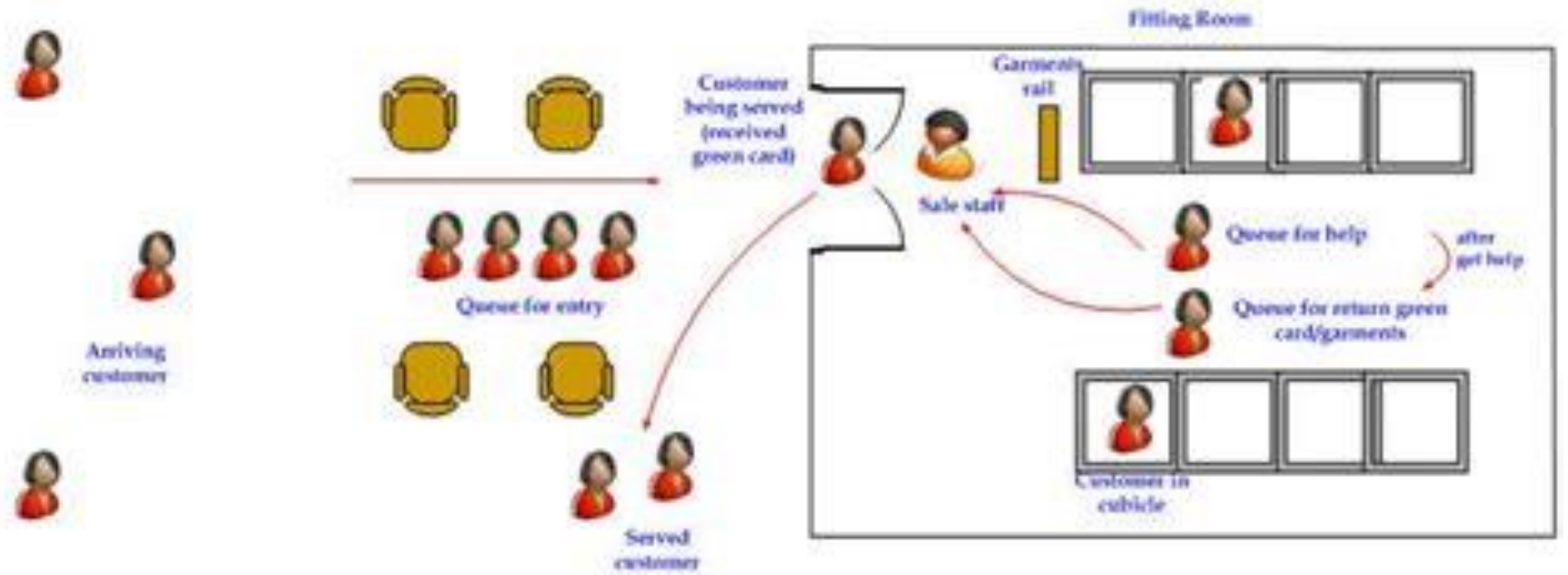
Example: Agent-based modeling 2



Example: Discrete Event Simulation 1



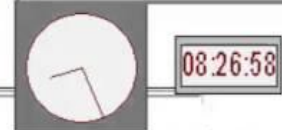
Example: Discrete Event Simulation 2



Example: Discrete Event Simulation 3



Number of Rheumatology physicians:	11
Number of patients arrived to Rheumatology:	11
Percentage of the rooms occupied by patients:	38%
Average LOS	8.5
Maximum LOS	8.5
Average wait time	0
Number of Orthopedics physicians:	8
Orthopedic patients arrived to MSK	32
Percentage of rooms occupied	50%
Orthopedic patients in MSK at current time	37
Average LOS	8.6
Average wait time	2.1
Number of patient require radiology	5
Percentage of X-ray rooms occupied	75%
Average LOS	2.6
Average wait time	1
Number of patient waiting in waiting area:	0
Number of "ortho" patients waiting:	1
Number of "Rheumo" patients waiting:	2
Number of patients waiting for "Radio":	0



Non-Balanced Scheduling