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Artificial Intelligence: Intro to COMS30014

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Nirav Ajmeri

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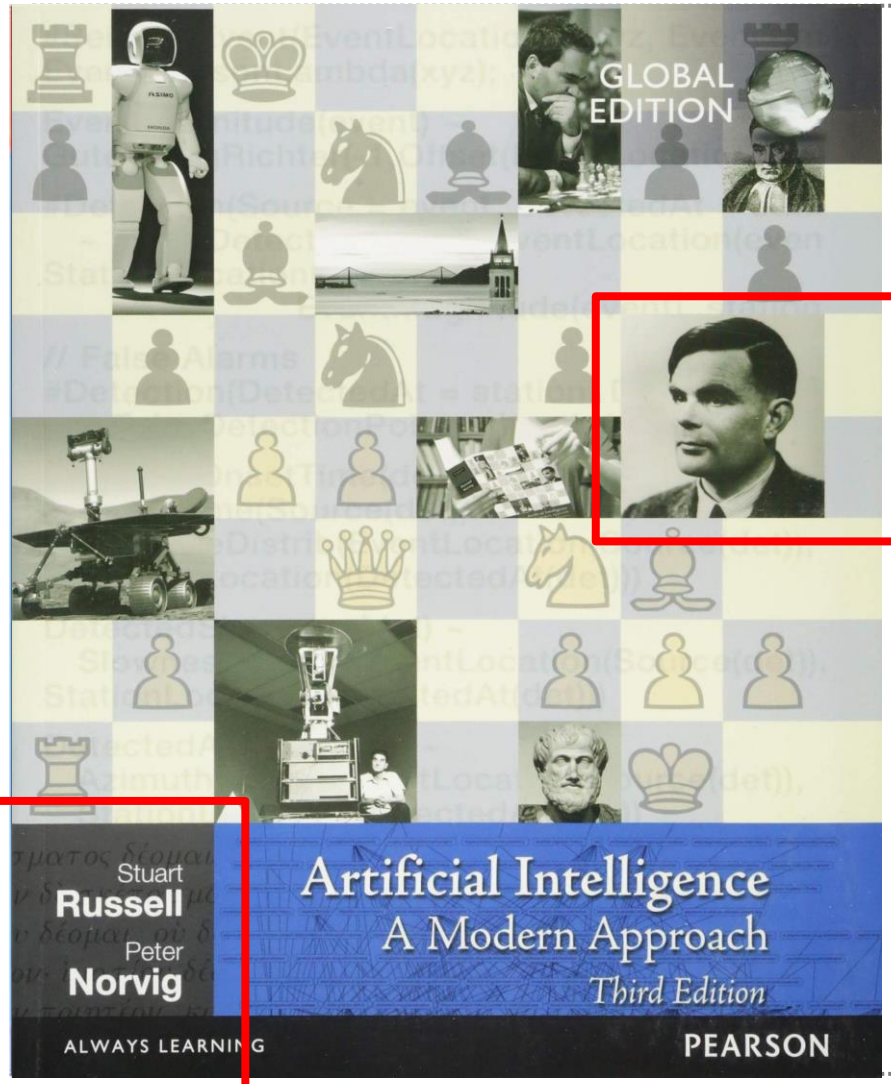
The Wide Scope of AI



- AI involves the use of machines to understand and reproduce and enhance all aspects of intelligent behaviour ranging from
  - Strong AI - addressing abstract general-purpose problem solving
  - Weak AI - addressing concrete domain-specific task performance
- We subscribe to an Embodied, Declarative, Intelligent Agent perspective which views AI as a synthesis of two key traditions
  - Knowledge-driven AI - symbolic, local, white-box (GOFAI)
  - Data-driven AI - connectionist, distributed black-box (DEEP-X)
- While AI currently has a strong focus on data-driven deep learning, this is covered in other courses (NOT HERE!)
- We believe a combination of the above dimensions is necessary to address contemporary issues within AI:
  - Transparency, Explainability, Interactivity, …

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Turing's 1950 Roadmap

After proposing his "Imitation Game" (primarily as a way to postpone unhelpful philosophical and formal debates that would likely hinder initial technical progress) Turing essentially identified the following AI paradigms:

- **Expert Systems**
  - Explicitly code the entirety of the information contained in the adult mind
  - 1960s-1980s (cf. Machine Intelligence series, 5th Generation Computer Systems Project, Cyc)
- **Supervised Learning**
  - Code only the core mechanisms of the child mind and then expose it to supervised education
  - 1980s-2010s (cf. Machine Learning journal, Deep Learning)
- **Reinforcement Learning**
  - Supplement learning with (unemotional) punishment/reward in a symbolic communication language
  - Ongoing (e.g. Interactive AI, Human-Like Computing Network, …)

I.—COMPUTING MACHINERY AND INTELLIGENCE | Mind | Oxford Academic (oup.com)

TuringAI.dvi (ic.ac.uk)

Home - Cyc

HLC (ic.ac.uk)

Explainable AI | Administration and support services | Imperial College London

https://epsrc.ukri.org/newsevents/pubs/human-like-computing-strategy-roadmap/

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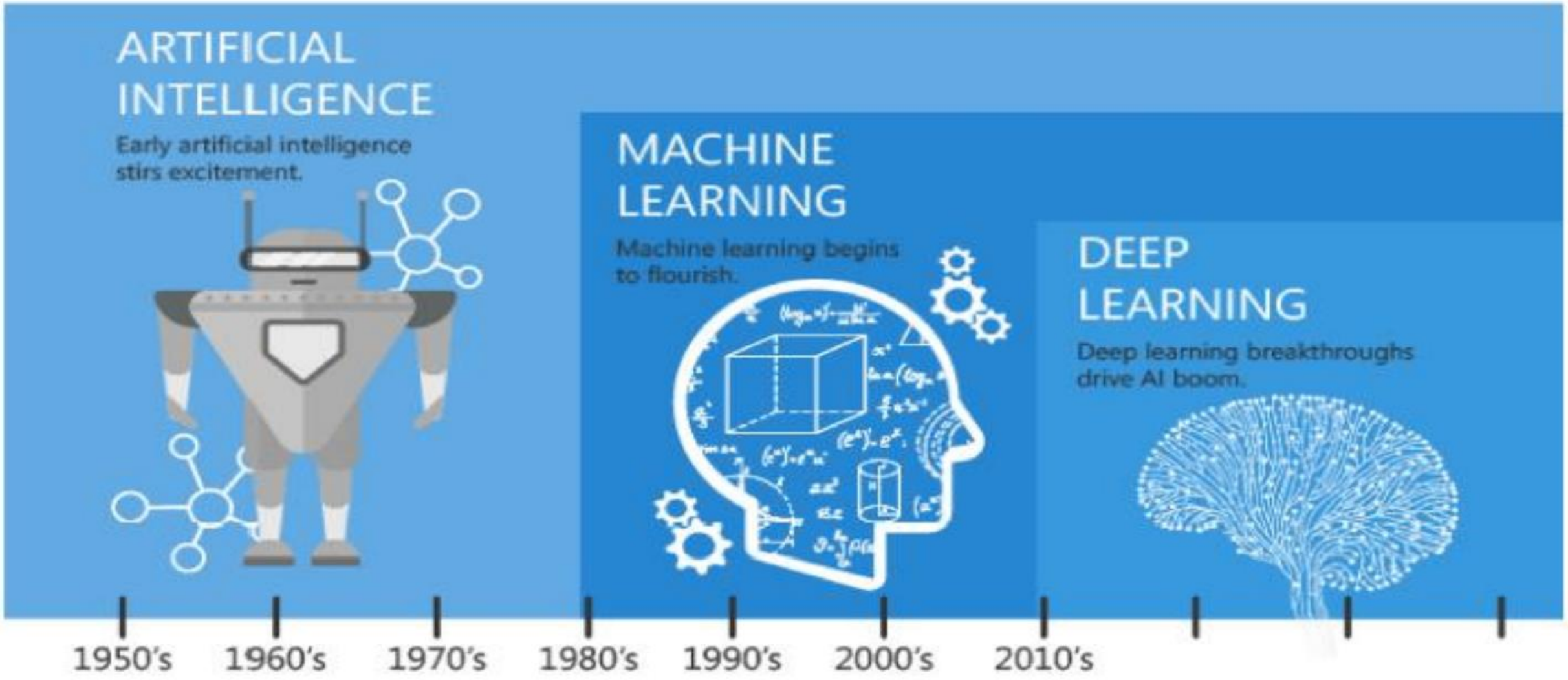
Artificially Restricted Public Perceptions



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Michie's ML Criteria (EWSL'88)

- **Weak criterion** of ML (Fig.1):
  - System … uses training data … for improved performance
  - International ML meetings … operating … unspoken **community criterion** (p.107) …"satisfies weak criterion and also involves some biology"
  - Scope of ML (Fig. 2): Neural Networks / Genetic Algorithms / Symbolic Methods
- **Strong criterion** of ML (Fig.3):
  - ... and also can communicate its internal updates in explicit symbolic form
  - New dictum (p.108): Until you have figured out a way for the machine to tell you what it has learned, it is not going to be very interesting to have it learn things anyway.
- **Ultra-strong criterion** of ML (Fig.3):
  - ... and also can communicate its internal updates in explicit and operationally effective symbolic form
  - It must also show skill in the role of coach

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Unit Philosophy

This unit gives an intro to knowledge-based methods that (we purport) could be used in combination with currently trendy approaches to better address current issues in AI:

- **Interpretable AI ?**
- **Comprehensible AI ?**
- **Explainable AI ?**
- **Interactive AI ?**
- **Trustworthy AI ?**
- **Ethical AI ?**

We will concentrate on three key topics:

- **Logic Programming**
- **Genetic Algorithms**
- **Mult-Agent Systems**

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Unit Overview

Week	Topic	Lecturer	Lab
1	Logic Programming I	Oliver Ray	Datalog / Movies
2	Logic Programming II	Oliver Ray	Prolog / GridWorld
3	Logic Programming III	Oliver Ray	Metalogic / Oscars
4	Genetic Algorithms I	Seth Bullock	Simple Genetic Algorithm
5	Genetic Algorithms II	Seth Bullock	Coevolutionary Genetic Algorithm
6	READING WEEK		
7	Multi-Agent Systems I	Nirav Ajmeri	MAS Simulation I / Mesa
8	Multi-Agent Systems II	Nirav Ajmeri	MAS Simulation II / Mesa
9	Timed Coursework		
10			
11			
12	Exam Preparation	Oliver, Seth, Nirav	
XMAS	Exam Revision		
JAP	Timed Exam		

search

problem solving

COMS30062 (20CP) with practical focus

COMS30013 (10CP) with conceptual focus

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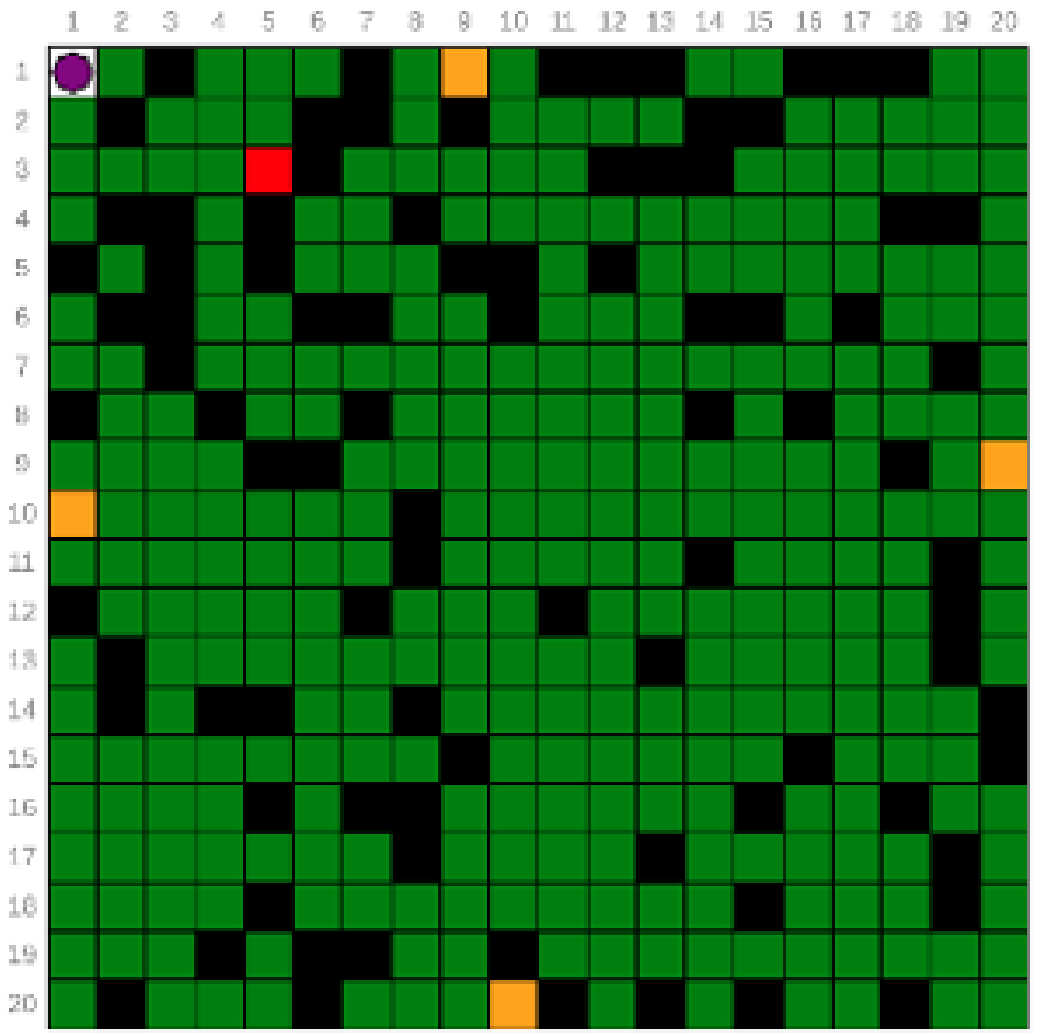
Unit Assessment (Exam & Coursework)



- Focus on Artificial GridWorld that **agents** must efficiently navigate by using **charging stations** to visit **oracles** and solve various **tasks**
- This context will help to develop understanding for the exam and will be directly used in the course-work; and it provides a nice link between Prolog and GAs and MAS

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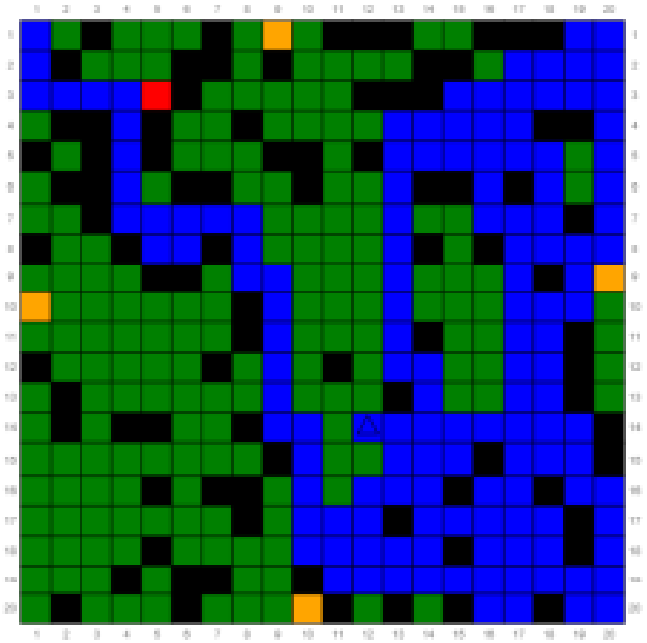
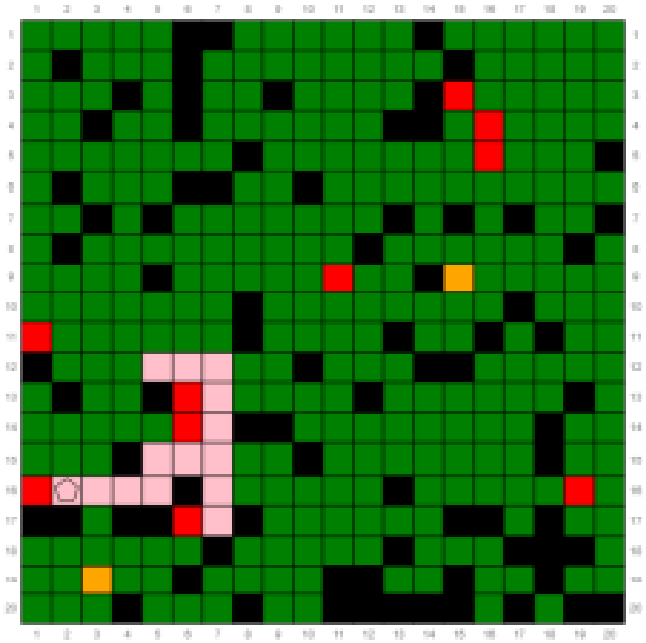
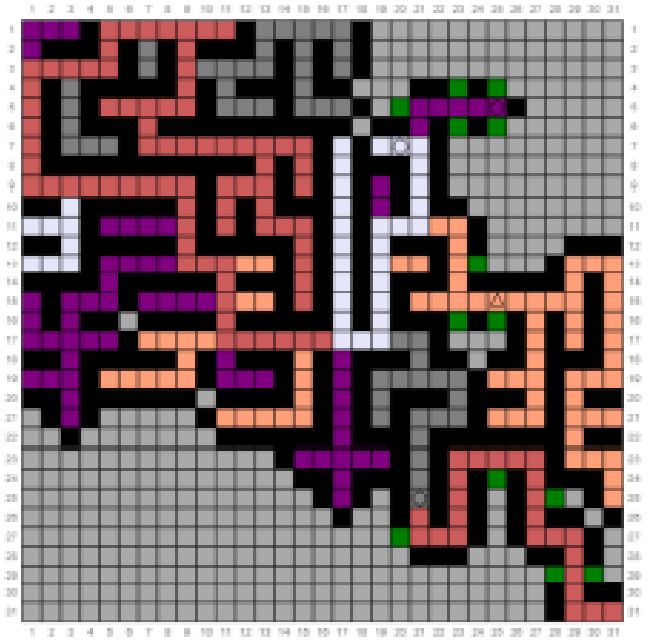
Example GridWorld Tasks



Use A* search to solve tasks of form: `find(Obj) ; go(Pos)`



visit and query oracles to find secret actor id



lead all agents out of the maze

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Lectures

- For Disseminating content, clarifying expectations, and giving you the opportunity to ask questions in person
- Wednesdays at 9-10am in Q1.18 Thursdays at 1-3pm in Q1.07
- In teaching weeks 1-5 & 7-8
- Mandatory for ALL students (both Exam and Coursework)
- Lectures are **not assessed** but **vital** for all students
- Lectures are **recorded** on Mediasite (to aid revision)
- You are strongly encouraged to ask questions

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In-Person Labs

- For consolidating taught content with self-study and giving you the opportunity to obtaining feedback from unit staff
- Mondays at 9-11 in MVB2.11 (in teaching weeks 1-5 & 7-8)
- Mandatory for ALL students (both Exam and Coursework)
- Comprising predefined TA-supported tutorial exercises
- Labs are **not assessed** but are **vital** for all students
- Labs are **not recorded** (so you must attend live)
- Work individually or in small groups (you need self-organise)
- Raise your hand to get help

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Non-Teaching Weeks

- No Lectures/Labs in week 6 (Reading Week)
- No Lectures/Labs in weeks 9-11 (Timed Coursework weeks)
- Exam Preparation Session in week 12 (for Exam students only)

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Unit Forum

- The best way to ask questions outside the live sessions
- Monitored by unit staff who will try to respond within 24hrs
- All students can benefit from seeing the answers
- You can post anonymously if you want
- You can get automatic email notifications (please enable)
- Keeps all information together in one convenient place
- Students are strongly encouraged to try and answer questions as well as asking them!

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Unit Staff

This unit is taught by three academics:

- **Oliver Ray** (director)
- **Seth Bullock**
- **Nirav Ajmeri**

And it is supported by the following Teaching Assistants:

- **Oliver Deane**

Please contact us in class or via the Unit Discussion Forum!

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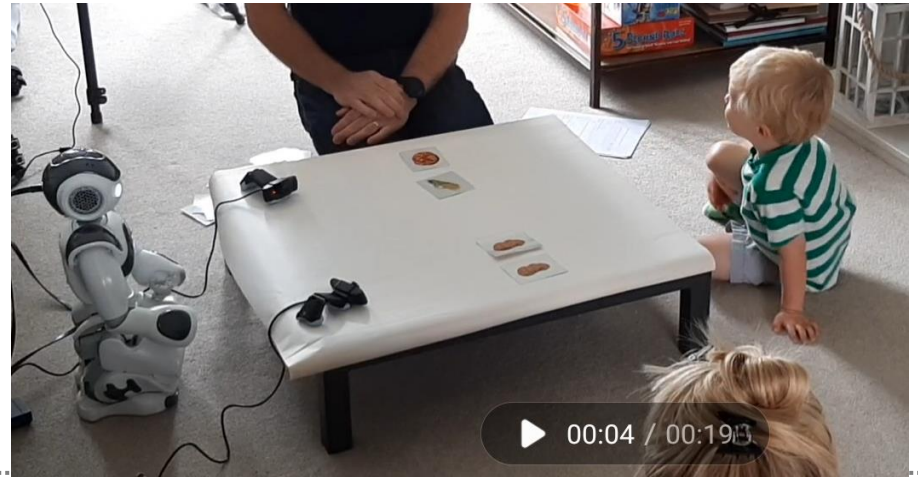
Oliver - Research Interests



- PhD, Imperial College
  - Abductive Logic Programming (PrologIcA, efficiency)
  - Inductive Logic Programming (HAIL, completeness)
- Research Fellow, University of Bristol
  - Answer Set Programming (XHAIL, non-monotonicity)
  - Machamer-Darden-Craver theory (Huginn, Robot Scientist)
- Senior Lecturer, University of Bristol
  - Event Calculus (XEC, temporal conflict resolution)
  - Cyber Security (Acuity, human-in-the-loop learing)
  - Normative Agents (InstAL+, round-trip revision)
  - Relational Frame Theory (Artomis, theory of mind)
  - Legal Informatics (SUMO, majority opinion in UKSC)
  - Research Director Interactive AI CDT (IAI)

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Oliver - Personal Interests

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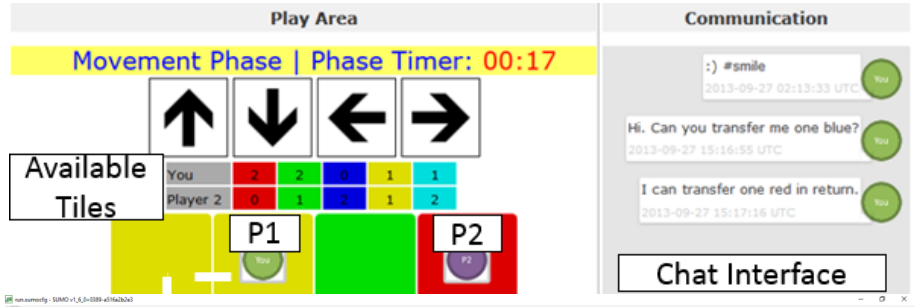
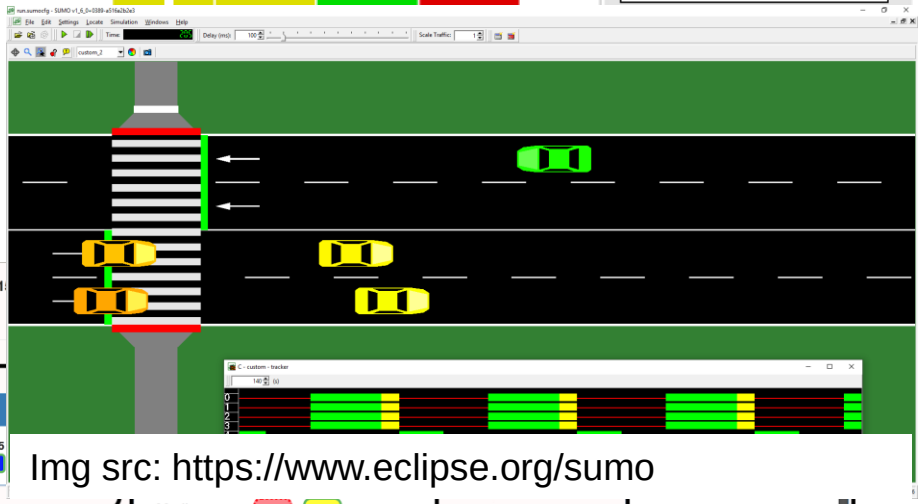
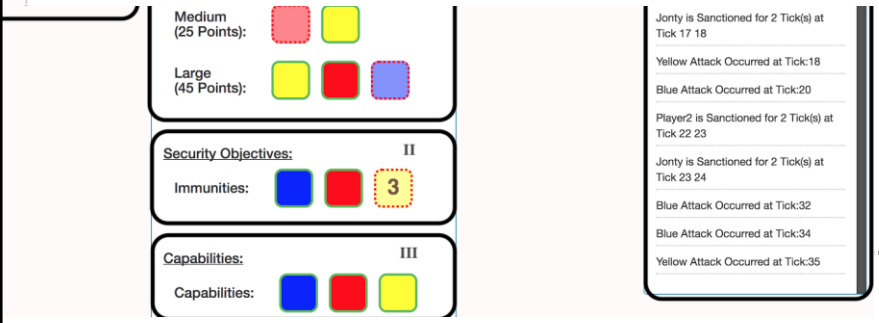
Nirav - Research Interests





Img src: https://www.eclipse.org/sumo



- Researcher, TCS-TRDDC, Pune, India
  - Software requirements engineering; Knowledge engineering
- PhD, NC State University, Raleigh NC, USA
  - Socially intelligent agents and multiagent systems
  - Sociotechnical systems
    - Formal specification, reasoning, and verification
    - Privacy and security
    - Ethics and fairness
- Postdoctoral Researcher, NC State University, Raleigh NC, USA
  - AI, ethics, and society
  - Software security
- Lecturer, University of Bristol
  - AI and prosociality
  - Bias and misinformation
  - Privacy and online harm

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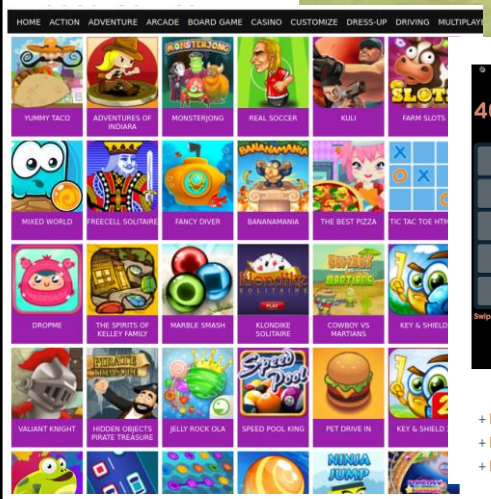
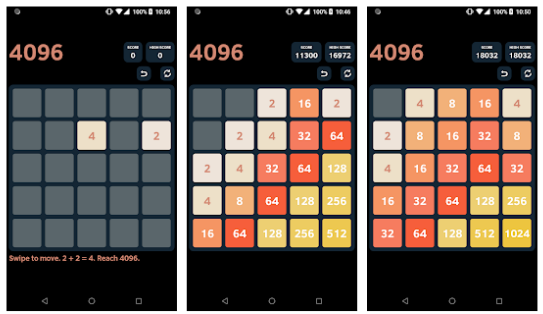
Nirav - Personal Interests





+ No Ads!
+ No permissions!
+ Dark mode for strain free viewing

- Cricket!
- Any sport
  - Badminton, Table Tennis, …
- Arcade gaming
- Board games and card games
- Travelling and trekking
  - Can't swim!

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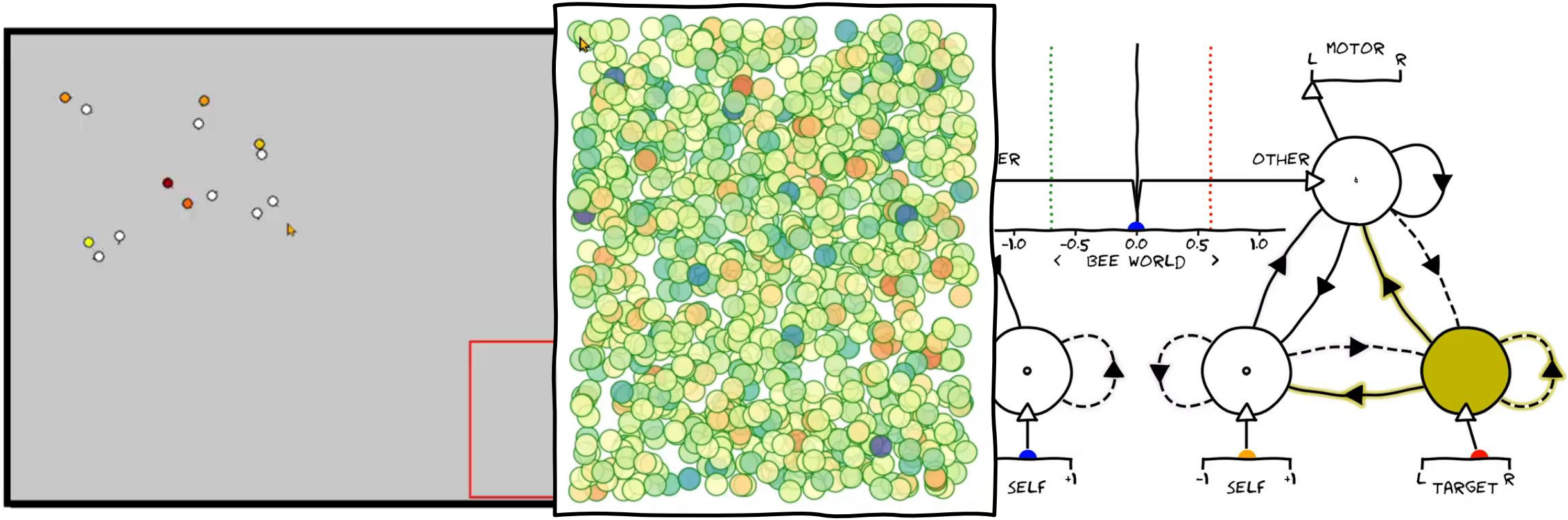
Research Interests: Seth

Artificial Life: Evolution, Collective Behaviour, Neuroscience, Agent Based Modelling, Robotics, Interdisciplinarity, Complex Systems Simulation, etc.



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Personal Interests: Seth

- Food – Cooking it, Eating it
- Music – Old Music, New Music

- West Ham – when we're winning..

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Thank you