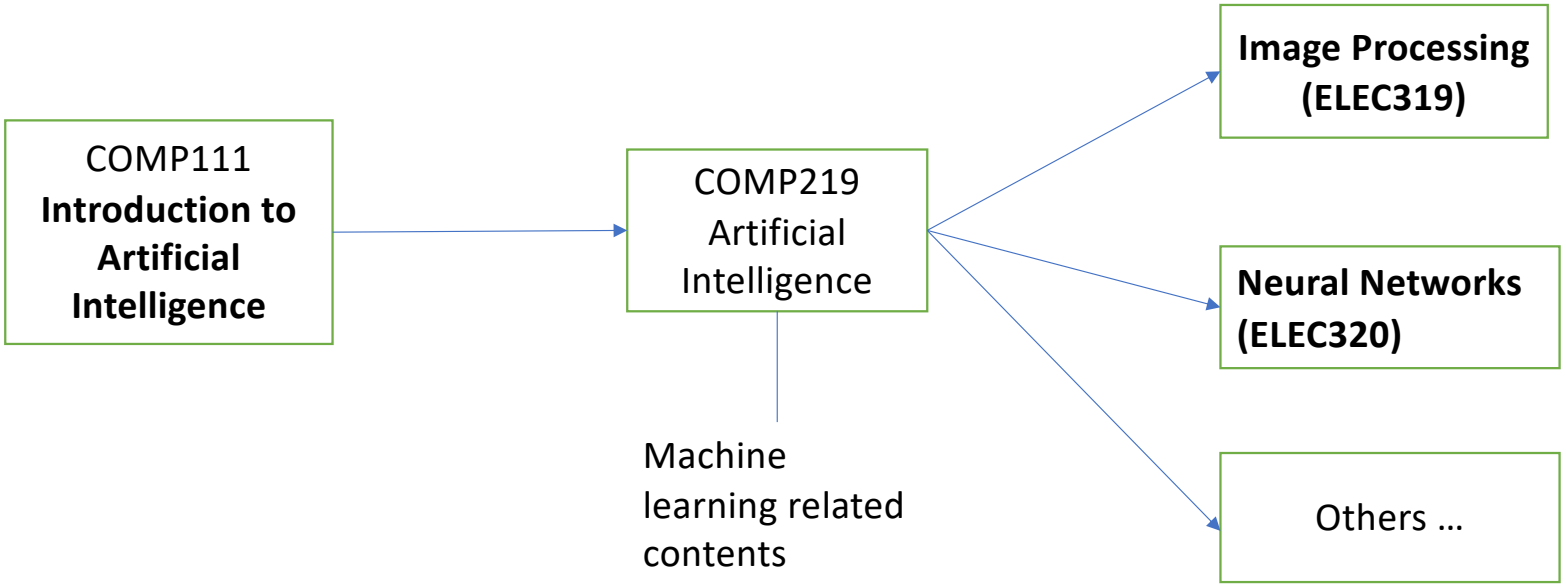
Welcome everyone to –

COMP219

Advanced Artificial Intelligence

- My website: https://cgi.csc.liv.ac.uk/~xiaowei/
- My lab's website: https://cgi.csc.liv.ac.uk/~acps/home/


COMP111
Introduction to Artificial Intelligence
COMP219
Artificial Intelligence
Machine learning related contents
Image Processing (ELEC319)
Neural Networks (ELEC320)
Others …

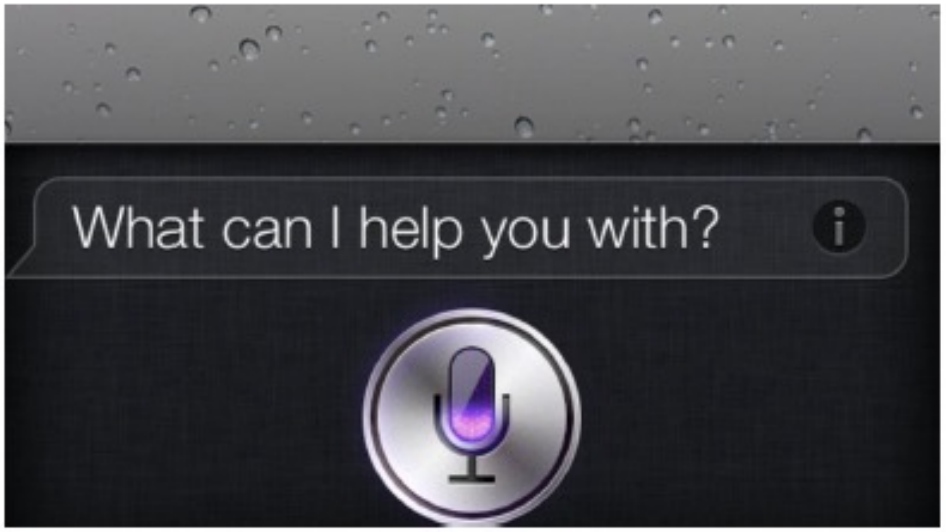
Introduction to COMP219

Prof. Xiaowei Huang

https://cgi.csc.liv.ac.uk/~xiaowei/

(Attendance Code: **709557**)


ALPHAGO
00:00:38
LEE SEDOL
00:01:00
AlphaGo
Google DeepMind


What can I help you with?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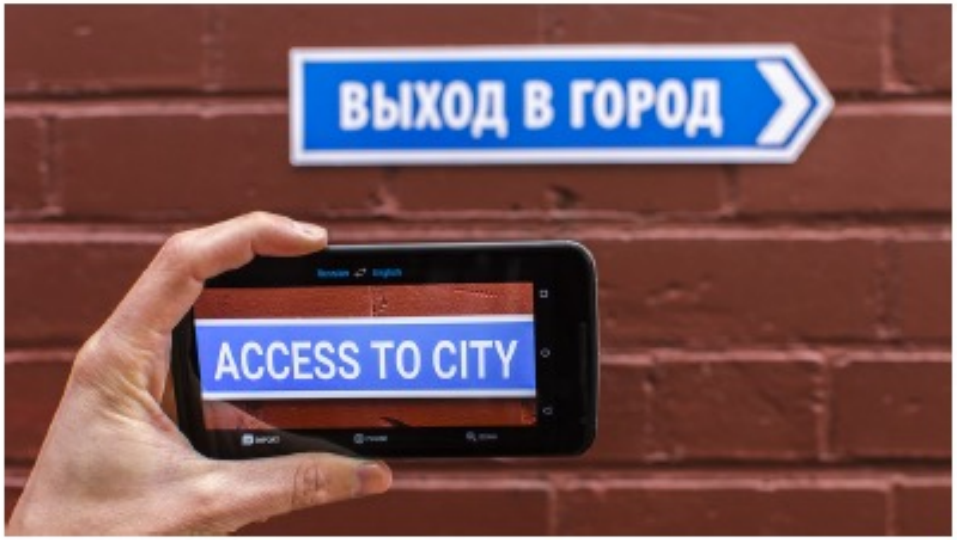
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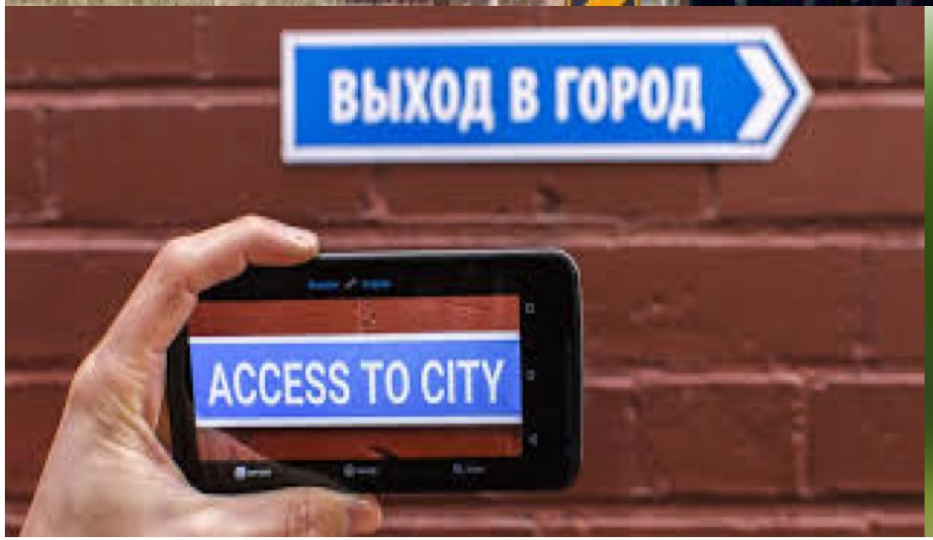
ACCESS TO CITY


405
SOUTH


PR2


20
10t


(+4.99)
189,413.27
(+12.64)
48,829.82
(+29.34)
52,394.62
(+7.30)
777.65
(+26.38)
1,002.66
15,127.81
(+6.63)
(+20.63)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OH
HO
HO

Risks – security problem?

—

AI can create synthetic fingerprints that fool biometric scanners

DeepMasterPrints can dupe systems that only compare partial prints.

https://www.engadget.com/2018-11-16-ai-fingerprints-biometric-scanners.html

Risks – privacy problem?

—

The Pentagon has a laser that identifies people by their heartbeat

You can't disguise your heartbeat.

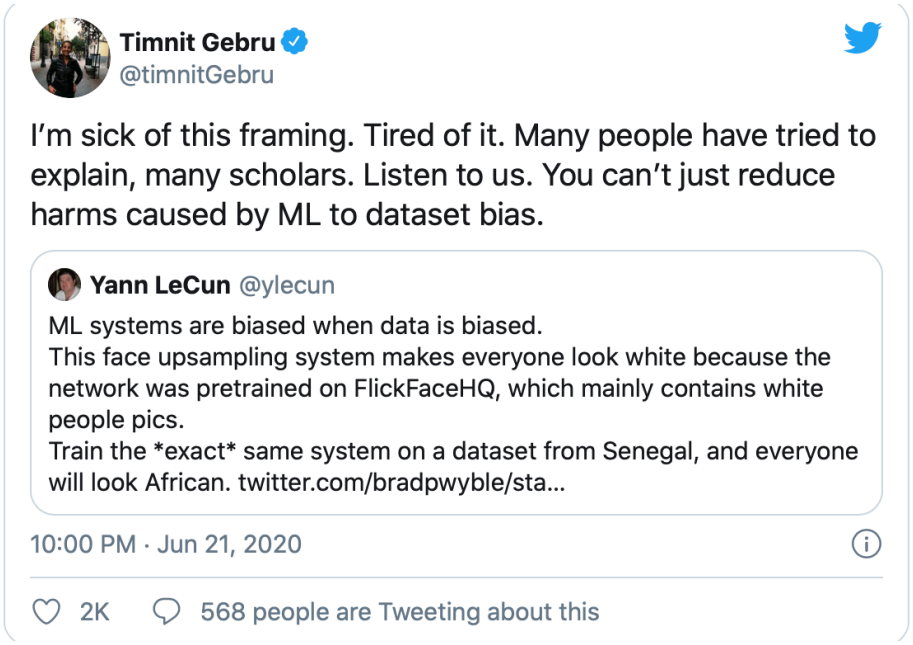
Rachel England, @rachel_england
June 27, 2019

33
Comments

40
Shares

https://www.engadget.com/2019-06-27-the-pentagon-has-a-laser-that-identifies-people-by-their-heartbe.html

Risk – bias?



When a blurred image of Barack Obama was fed to the model, it blurted out an image of a Caucasian male. Given the situation right now in the US, it didn't take long for the people to come down heavy on the lack of diversity in ML

Many apps are AI-driven.

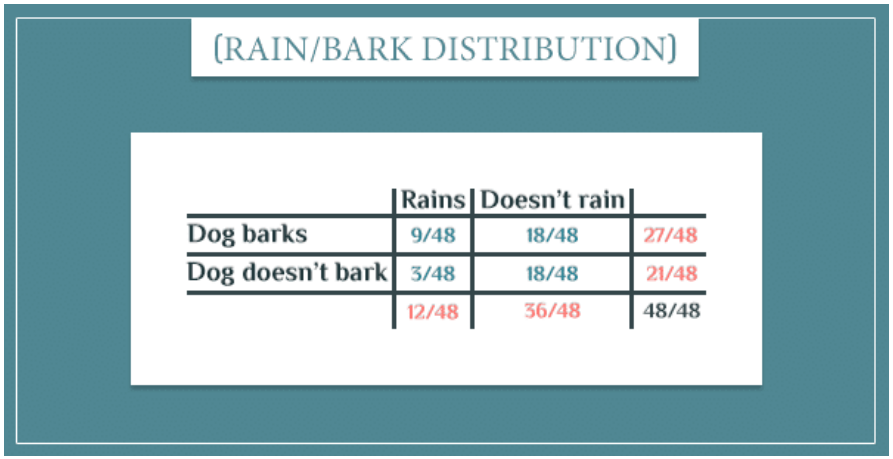
But to know how to create them (**in a responsible way**), it is nothing easy.

This module is to establish a foundation for you to be able to do them in the future.

Pre-requisite Knowledge - Probability

Number of Orders per Week x_i	Probability p_i
41	.03
42	.10
43	.15
44	.17
45	.25
46	.15
47	.10
48	.05

(1)



(2)

Pre-requisite knowledge – linear algebra

$$A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \end{bmatrix}$$

(1)

$$x = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix} * \begin{pmatrix} 9 \\ 8 \\ 7 \end{pmatrix}$$

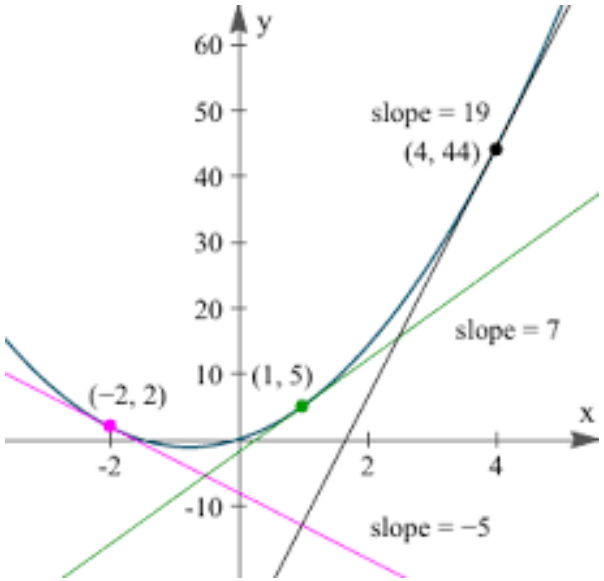
$$1*9+2*8+3*7=46$$

$$4*9+5*8+6*7=118$$

$$x = \begin{pmatrix} 46 \\ 118 \end{pmatrix}$$

(2)

Pre-requisite knowledge – derivative and partial derivative



(1)

$$z = 3x^2 + 2xy - y^2$$

$$= 3(1)^2 + 2(1)(2) - (2)^2$$

$$= 3$$

$$\frac{\partial z}{\partial x} = 6x + 2y = 6(1) + 2(2) = 10$$

$$\frac{\partial z}{\partial x} = 2x + 2y = 2(1) + 2(2) = 6$$

(2)

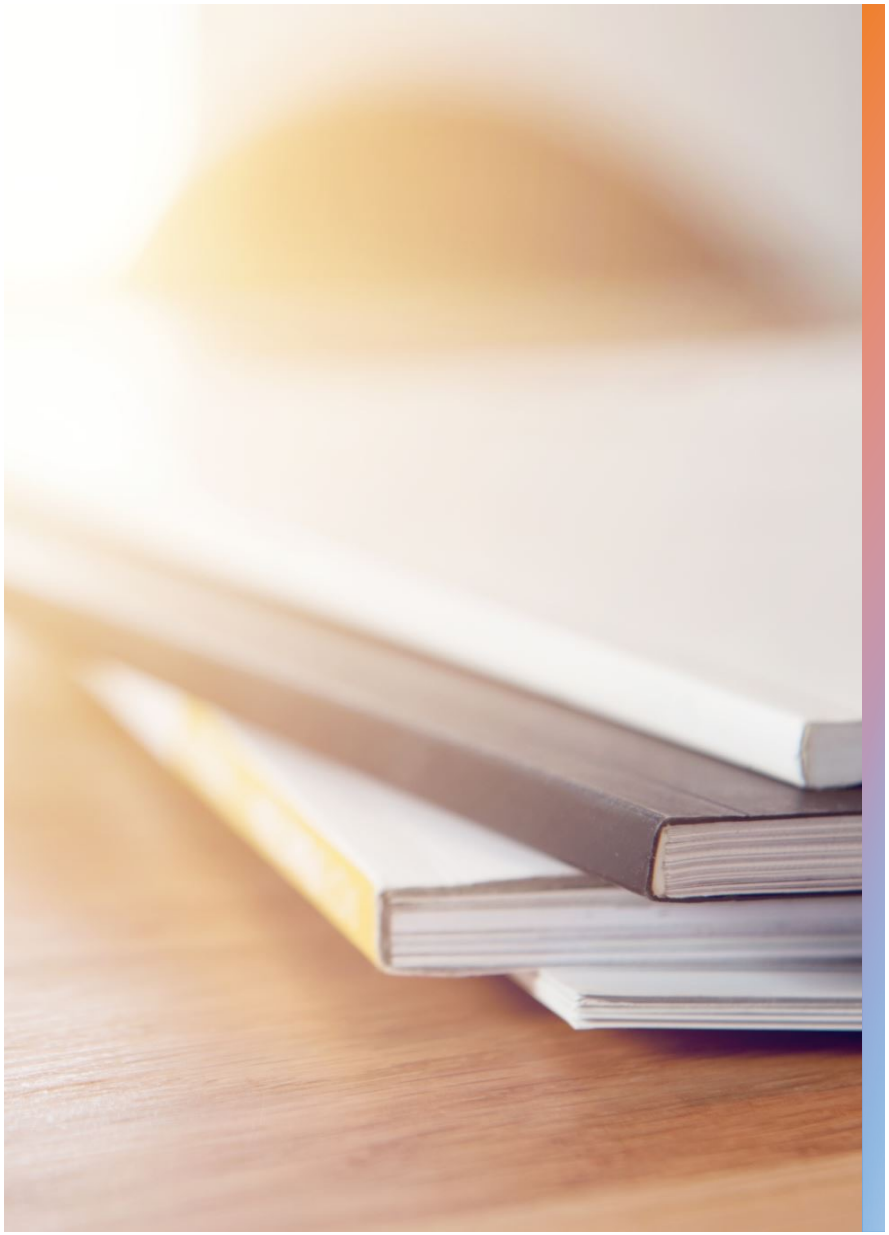
Warning

A lot of maths in the first few weeks.

If you choose this module, make sure that you are prepared (with knowledge, passion, persistency, etc)

Today’s Content

- Module Information
- Contents of the module



Module Outline

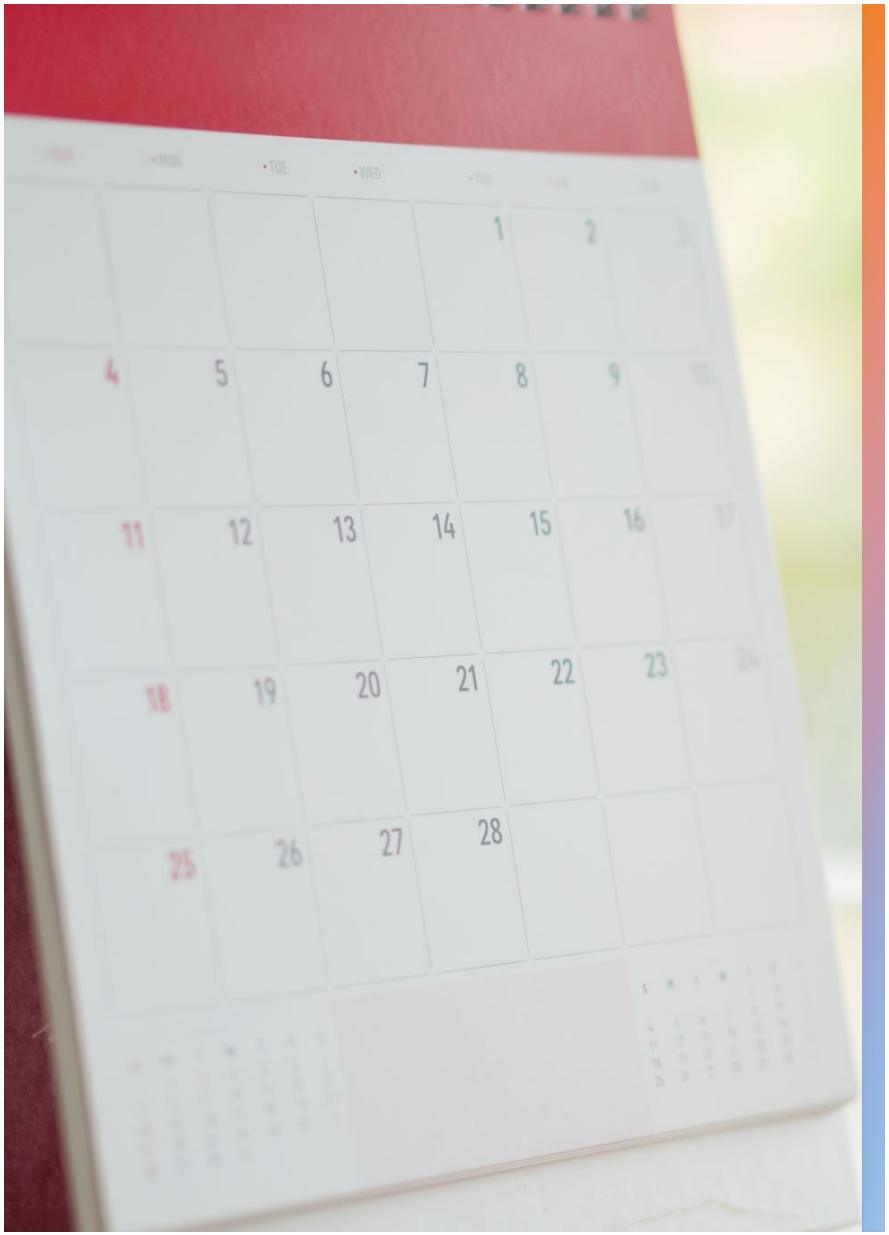
- The module consists of
  - 25~30 lectures
  - ~9 lab sessions

- Please ensure sufficient time on self study

Module Outline

- Assessment
  - a 1.5-hour MCQ exam (70%)
  - two practical assignments (30%), submitted altogether at the end of the semester. All submissions will attend an attack-defence competition.

- Module information on Canvas



Module Delivery: Demonstrators

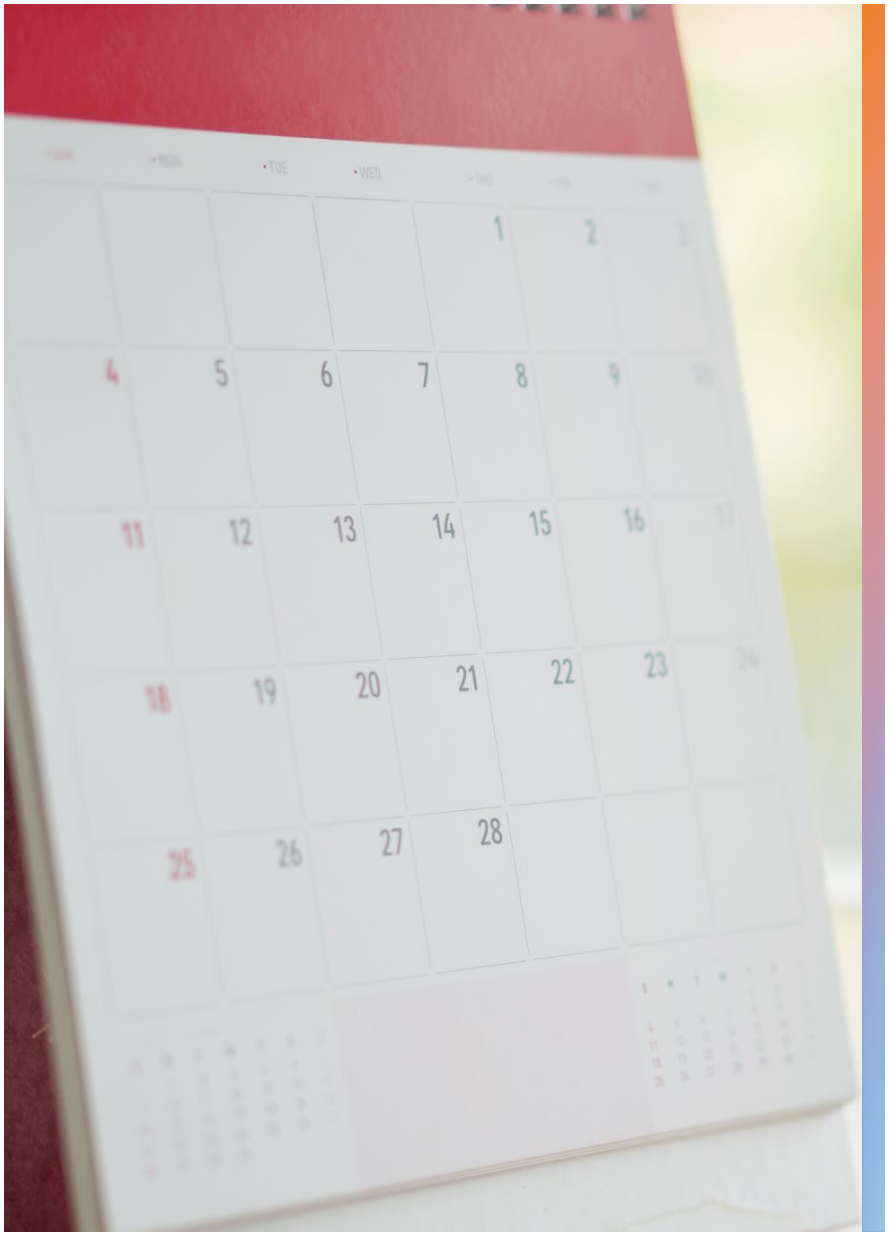
- 9 lab sessions
- 220 students registered
- Who is going to support this?
  - Mr Efthyvoulos Drousiotis
  - Mr Joshua Murphy
  - Mr Nikos Theofilis Sobrino

Timetable: Lectures

- Monday 16-17
- Tuesday 11-10
- Wednesday 9-10

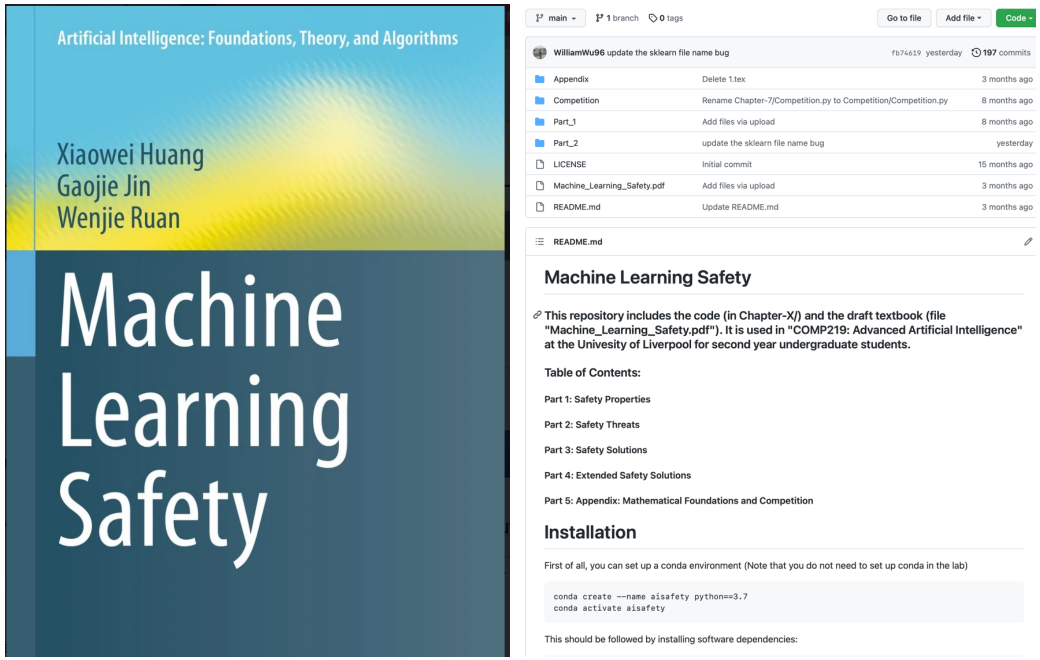
- Slides will be distributed

- Will inform you through Canvas if I have to travel and cannot do lectures, so please watch your emails and canvas notification.

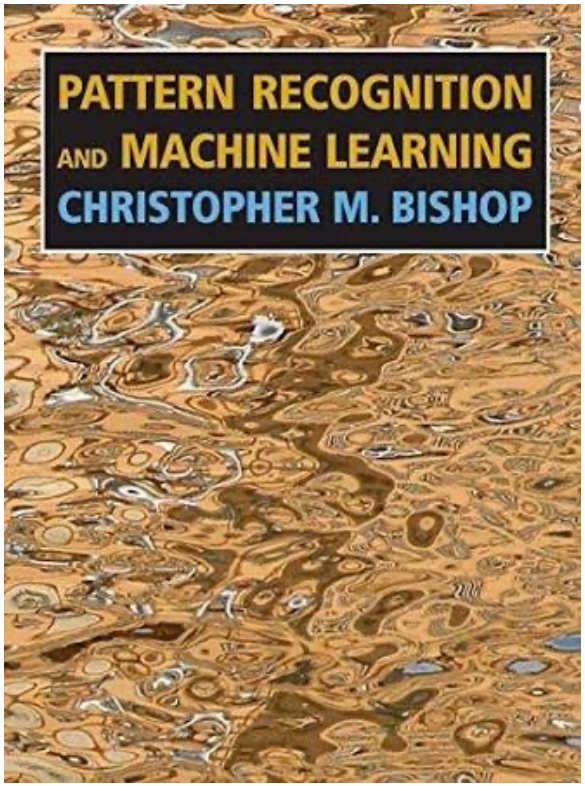


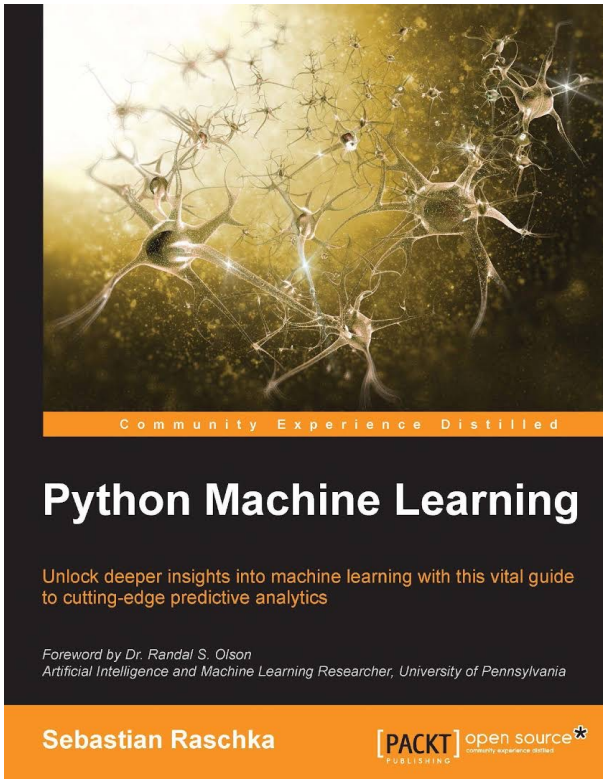
Teaching Materials

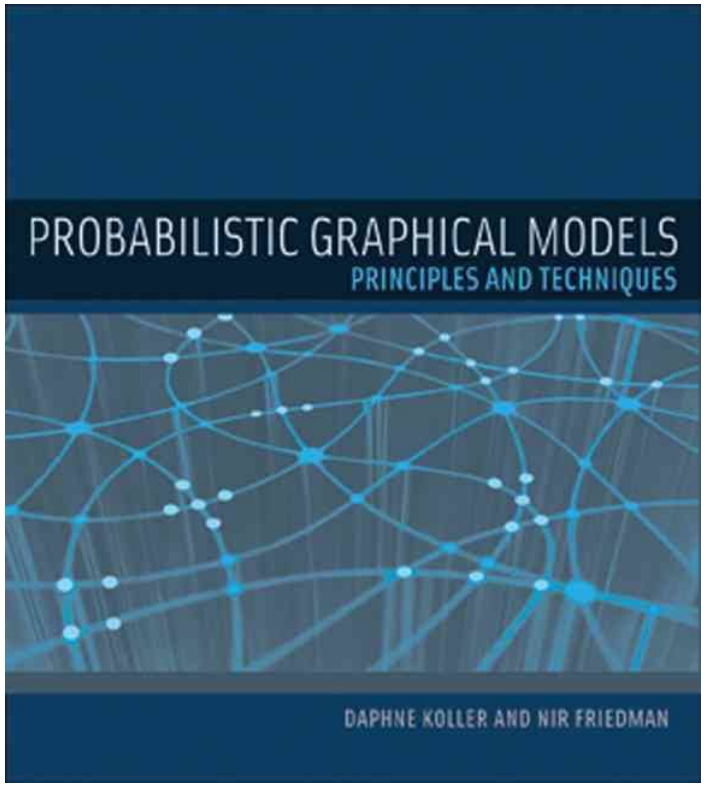
- https://github.com/xiaoweih/AISafetyLectureNotes
  - Lecture notes, including all the theoretical knowledge you may need for this module
  - Lab practice, appears in “Practice” section of each chapter



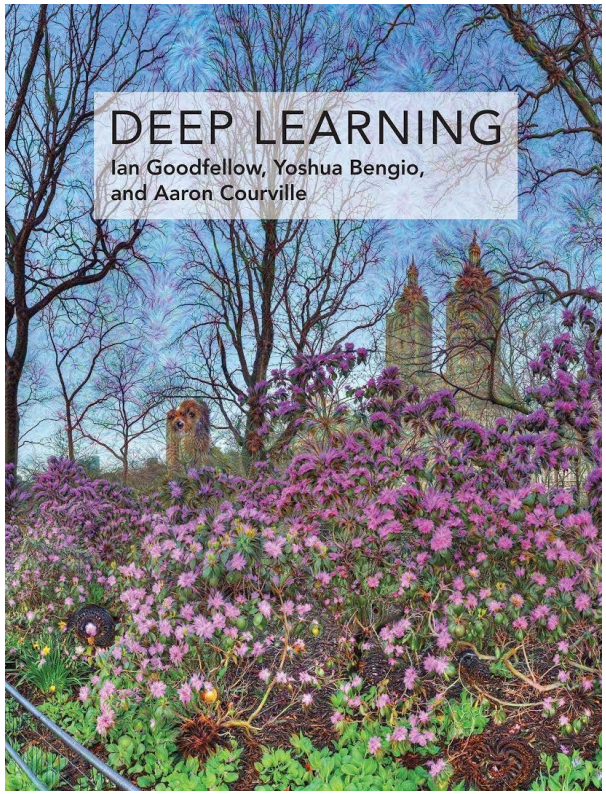
Other Readings

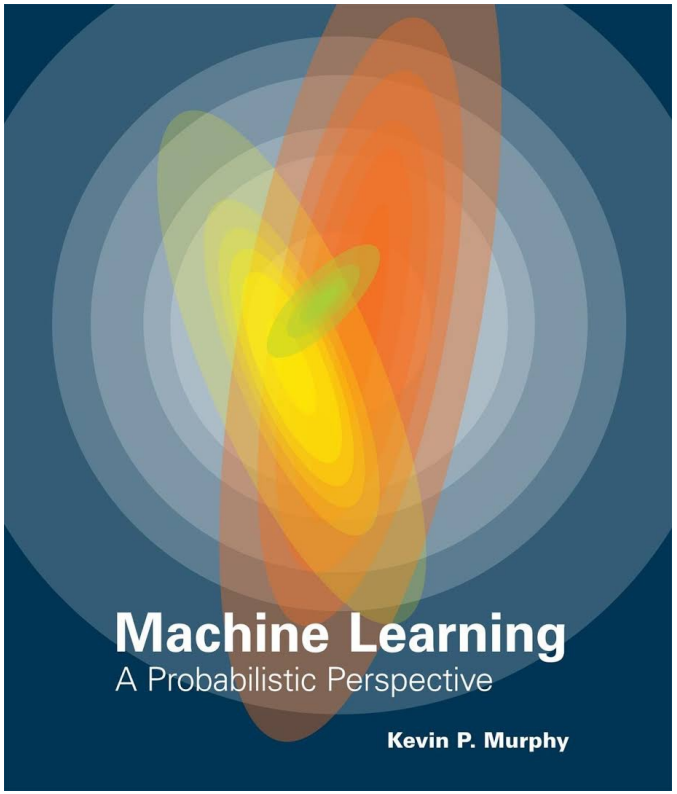






Other Reading:





Other Reading:

- Tensorflow/PyTorch on-line documentations
- Github (plenty of resources, code, tutorials, etc)
- Various on-line courses
- Reddit, quite some good discussions. Experts are around there.
- Kaggle competitions, you can participate in to get more hand-on experience
- Wikipedia, for various concepts, key pointers, etc
- …. Many other on-line resources, please Google whatever you want

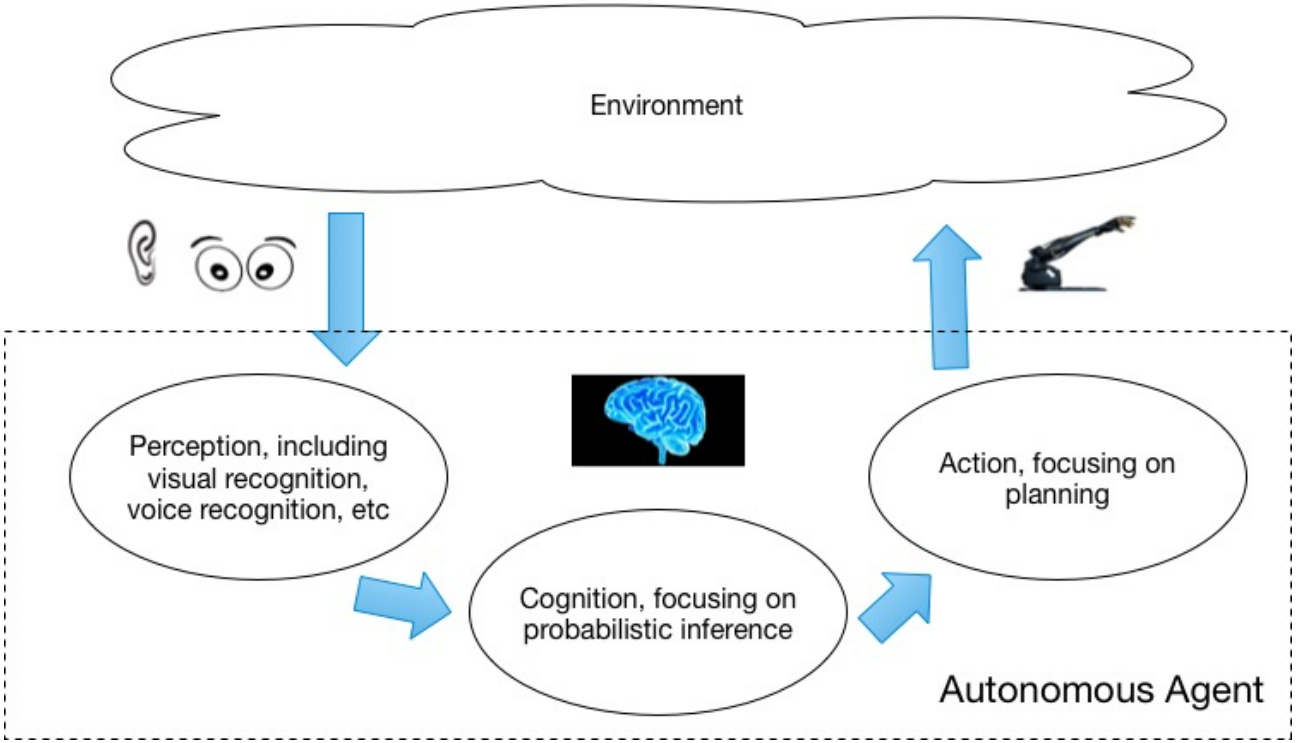
COMP111

- Brief history of AI including recent developments
- Intelligent Agents: A classification
- Search (applications: route planning, game playing)
- Knowledge Representation (applications: structured web search output)
- Reasoning under Uncertainty (application: almost everywhere)
- Learning (applications: face recognition, selfdriving cars)
- Philosophy and Ethics of AI (motivation: deducing sexual orientation from your picture ok? Visit `https:`

Aims

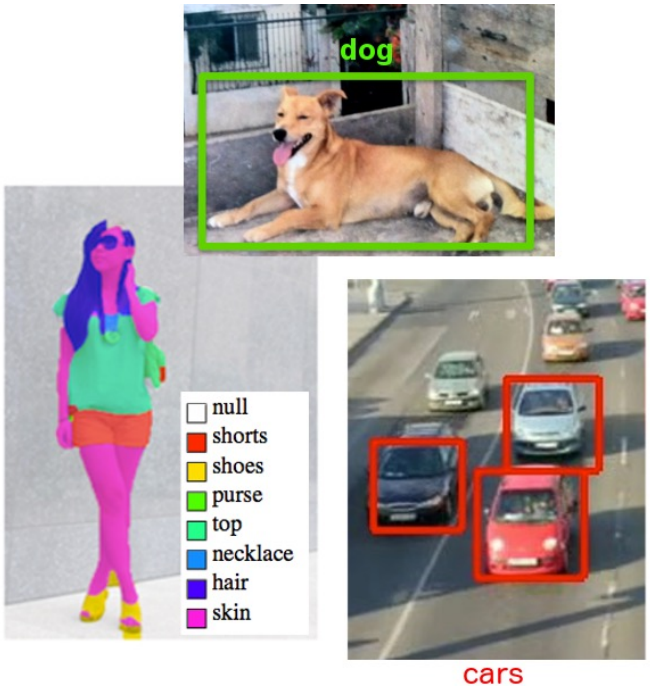
- To equip students with the knowledge about basic algorithms that have been used to enable the AI agents to conduct the perception, inference, and planning tasks;
- To equip students with the knowledge about machine learning algorithms;
- To provide experience in applying basic AI algorithms to solve problems;
- To provide experience in applying machine learning algorithms to practical problems;

Perception-Cognition-Action Loop



Teaching content:
traditional learning,
deep learning

Perception



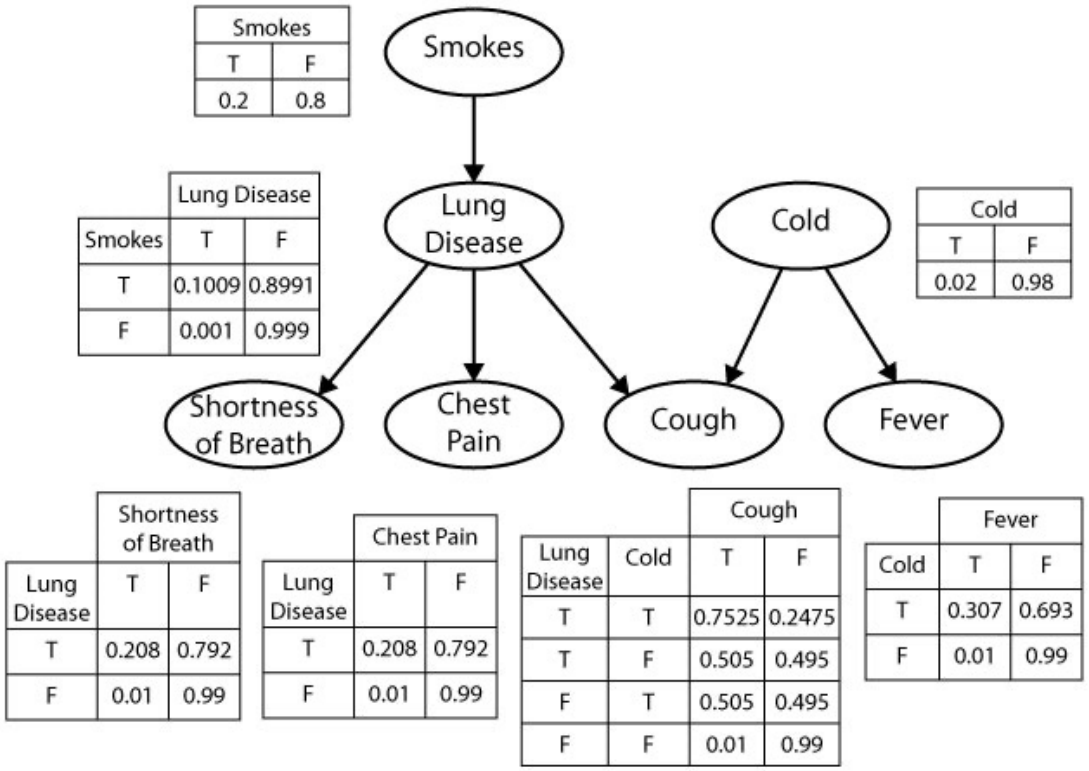
Visual Recognition

Voice Recognition

...

Teaching content:
Probabilistic graphical models

Cognition by Probabilistic Inference



Smokes	
T	F
0.2	0.8

	Lung Disease	
Smokes	T	F
T	0.1009	0.8991
F	0.001	0.999

Cold	
T	F
0.02	0.98

	Shortness of Breath	
Lung Disease	T	F
T	0.208	0.792
F	0.01	0.99

	Chest Pain	
Lung Disease	T	F
T	0.208	0.792
F	0.01	0.99

		Cough	
Lung Disease	Cold	T	F
T	T	0.7525	0.2475
T	F	0.505	0.495
F	T	0.505	0.495
F	F	0.01	0.99

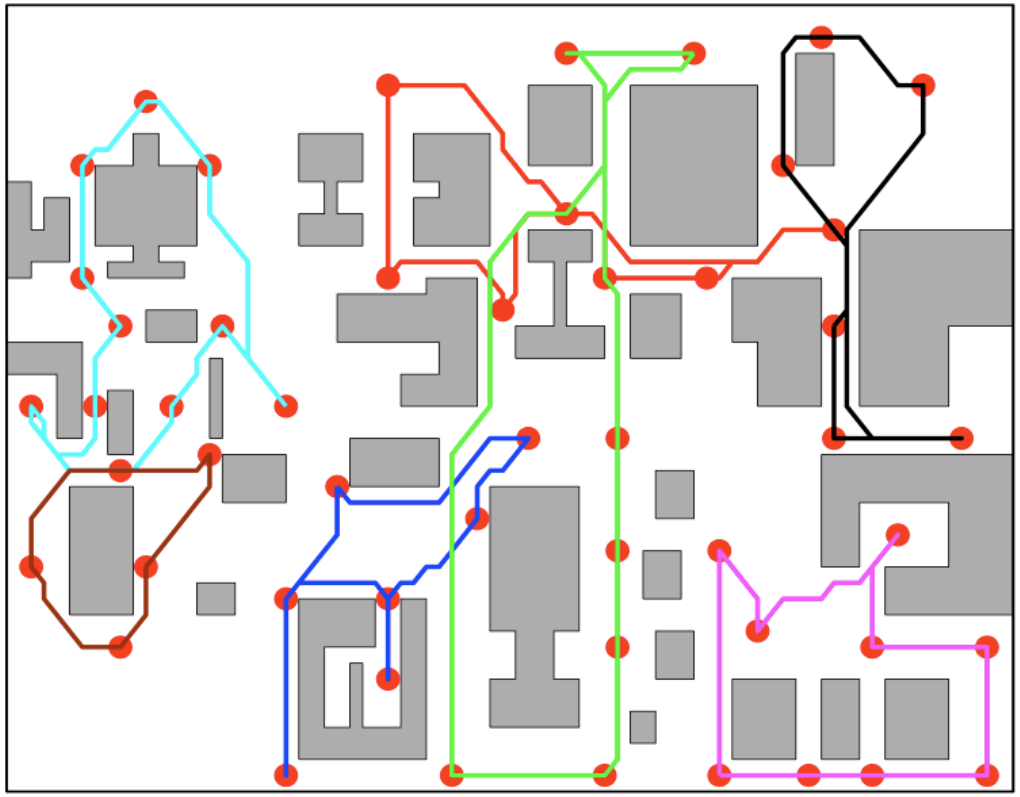
	Fever	
Cold	T	F
T	0.307	0.693
F	0.01	0.99

Q. how to automatically infer the disease (e.g., lung disease, cold, etc) from the symptoms (e.g., smokes, shortness of breath, chest pain, cough, fever, etc)?

Note: Symptoms obtained from perception.

Teaching content:
in other modules, e.g., COMP111, COMP222

Action by Planning



After cognition, we may use the obtained knowledge to react to the environment

Q: in the factory floor as shown in the left diagram, how many robots is needed to patrol the area? and **how to plan** their activities?

Learning Outcomes

Ability to explain in detail how the techniques in the perceive-inference-action loop work

Ability to choose, compare, and apply suitable basic learning algorithms to simple applications

Ability to explain how deep neural networks are constructed and trained, and apply deep neural networks to work with large scale datasets

Ability to conduct probabilistic inference.