

人工智慧

(Artificial Intelligence)

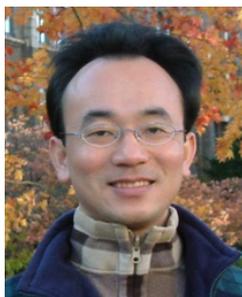
人工智慧概論

(Introduction to Artificial Intelligence)

1092AI01

MBA, IM, NTPU (M5010) (Spring 2021)

Wed 2, 3, 4 (9:10-12:00) (B8F40)



Min-Yuh Day

戴敏育

Associate Professor

副教授

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2021-02-24





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Publications Co-Chairs, IEEE/ACM International Conference on
Advances in Social Networks Analysis and Mining (ASONAM 2013-)

Program Co-Chair, IEEE International Workshop on
Empirical Methods for Recognizing Inference in Text (IEEE EM-RITE 2012-)

Publications Chair, The IEEE International Conference on
Information Reuse and Integration (IEEE IRI)



人工智慧

(Artificial Intelligence)

Contact Information

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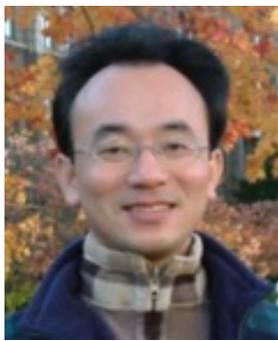
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國立臺北大學

109學年度第2學期

課程大綱

Spring 2021 (2021.02 - 2021.06)

- 課程名稱：**人工智慧 (Artificial Intelligence)**
- 授課教師：戴敏育 (Min-Yuh Day)
- 開課系所：資管所碩士班
- 開課資料：選修 半學年 3 學分 (3 Credits, Elective)
- 上課時間：週三 2, 3, 4 (9:10-12:00)
- 上課教室：商7F40 (台北大學三峽校區)

教學目標

1. 瞭解人工智慧基本概念與研究議題。○
2. 具備人工智慧實務操作能力。○
3. 進行人工智慧相關之資訊管理研究。○

Course Objectives

1. Understand the fundamental concepts and research issues of Artificial Intelligence.
2. Equip with Hands-on practices of Artificial Intelligence.
3. Conduct information systems research in the context of Artificial Intelligence.

內容綱要

- 本課程介紹**人工智慧基本概念**、**研究議題**、**與實務操作**。
- 課程內容包括
 1. 人工智慧概論
 2. 人工智慧和智慧代理人
 3. 問題解決
 4. 知識推理和知識表達、不確定知識和推理
 5. 監督式學習
 6. 學習理論與綜合學習
 7. 深度學習、強化學習
 8. 自然語言處理、深度學習自然語言處理
 9. 機器人技術
 10. 人工智慧的哲學與倫理與人工智慧的未來
 11. 人工智慧個案研究

Course Outline

- This course introduces the **fundamental concepts**, **research issues**, and **hands-on practices** of **Artificial Intelligence**.
- Topics include
 1. Introduction to Artificial Intelligence
 2. Artificial Intelligence and Intelligent Agents
 3. Problem Solving
 4. Knowledge, Reasoning and Knowledge Representation, Uncertain Knowledge and Reasoning
 5. Supervised Learning
 6. The Theory of Learning and Ensemble Learning
 7. Deep Learning, Reinforcement Learning
 8. Natural Language Processing, Deep Learning for Natural Language Processing
 9. Robotics
 10. Philosophy and Ethics of AI and the Future of AI
 11. Case Study on AI.

資訊管理研究所 系核心能力 (Core Competence)

- 資訊科技新知探索與系統開發應用 80 %
- 網路行銷企劃能力 10 %
- 論文寫作與獨立研究能力 10 %

校四大基本素養

(Four Fundamental Qualities)

- 專業 (Professionalism)
 - 創意思考與問題解決 (Creative thinking and Problem-solving) 30 %
 - 綜合統整 (Comprehensive Integration) 30 %
- 人際 (Interpersonal Relationship)
 - 溝通協調 (Communication and Coordination) 10 %
 - 團隊合作 (Teamwork) 10 %
- 倫理 (Ethics)
 - 誠信正直 (Honesty and Integrity) 5 %
 - 尊重自省 (Self-Esteem and Self-reflection) 5 %
- 國際觀 (International Vision)
 - 多元關懷 (Caring for Diversity) 5 %
 - 跨界宏觀 (Interdisciplinary Vision) 5 %

商學院學習目標 (College Learning Goals)

- Ethics/Corporate Social Responsibility
- Global Knowledge/Awareness
- Communication
- Analytical and Critical Thinking

系所學習目標

(Department Learning Goals)

- Information Technologies and System Development Capabilities
- Internet Marketing Management Capabilities
- Research capabilities

課程大綱 (Syllabus)

- | 週次 (Week) | 日期 (Date) | 內容 (Subject/Topics) |
|-----------|------------|--|
| 1 | 2021/02/24 | 人工智慧概論 (Introduction to Artificial Intelligence) |
| 2 | 2021/03/03 | 人工智慧和智慧代理人 (Artificial Intelligence and Intelligent Agents) |
| 3 | 2021/03/10 | 問題解決 (Problem Solving) |
| 4 | 2021/03/17 | 知識推理和知識表達 (Knowledge, Reasoning and Knowledge Representation) |
| 5 | 2021/03/24 | 不確定知識和推理 (Uncertain Knowledge and Reasoning) |
| 6 | 2021/03/31 | 人工智慧個案研究 I (Case Study on Artificial Intelligence I) |

課程大綱 (Syllabus)

| 週次 (Week) | 日期 (Date) | 內容 (Subject/Topics) |
|-----------|------------|---|
| 7 | 2021/04/07 | 放假一天 (Day off) |
| 8 | 2021/04/14 | 機器學習與監督式學習 (Machine Learning and Supervised Learning) |
| 9 | 2021/04/21 | 期中報告 (Midterm Project Report) |
| 10 | 2021/04/28 | 學習理論與綜合學習 (The Theory of Learning and Ensemble Learning) |
| 11 | 2021/05/05 | 深度學習 (Deep Learning) |
| 12 | 2021/05/12 | 人工智慧個案研究 II (Case Study on Artificial Intelligence II) |

課程大綱 (Syllabus)

- | 週次 (Week) | 日期 (Date) | 內容 (Subject/Topics) |
|-----------|------------|--|
| 13 | 2021/05/19 | 強化學習 (Reinforcement Learning) |
| 14 | 2021/05/26 | 深度學習自然語言處理 (Deep Learning for Natural Language Processing) |
| 15 | 2021/06/02 | 機器人技術 (Robotics) |
| 16 | 2021/06/09 | 人工智慧哲學與倫理，人工智慧的未來 (Philosophy and Ethics of AI, The Future of AI) |
| 17 | 2021/06/16 | 期末報告 I (Final Project Report I) |
| 18 | 2021/06/23 | 期末報告 II (Final Project Report II) |

教學方法與教學活動

(Teaching methods and activities)

- 講授 (Lecture)
- 討論 (Discussion)
- 實習 (Practicum)

評量方式

(Evaluation Methods)

- 個人報告 (Individual Presentation) 60 %
- 團體報告 (Group Presentation) 10 %
- 個案分析報告 (Case Report) 10 %
- 課堂參與 (Class Participation) 10 %
- 作業 (Assignment) 10 %

指定用書 (Required Texts)

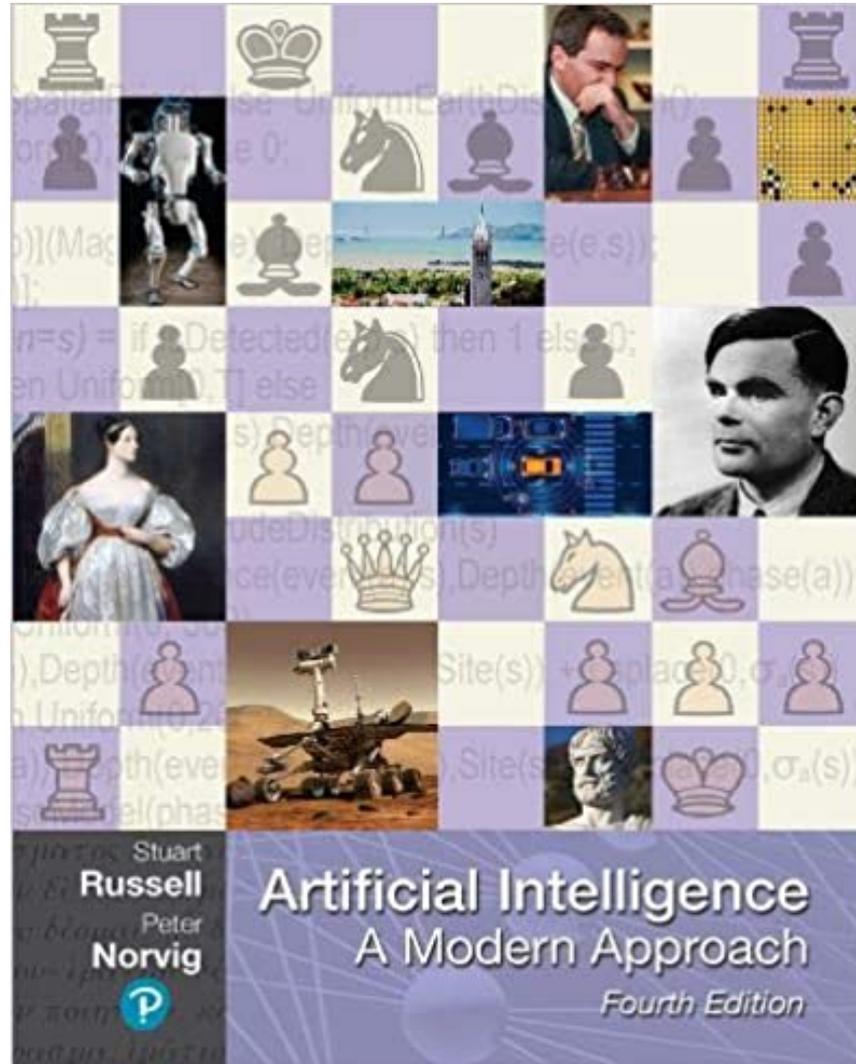
- Stuart Russell and Peter Norvig (2020),
Artificial Intelligence: A Modern Approach,
4th Edition, Pearson.

參考書目

(Reference Books)

- Aurélien Géron (2019),
**Hands-On Machine Learning with Scikit-Learn, Keras,
and TensorFlow: Concepts, Tools, and Techniques to
Build Intelligent Systems,**
2nd Edition, O'Reilly Media.

Stuart Russell and Peter Norvig (2020),
Artificial Intelligence: A Modern Approach,
4th Edition, Pearson

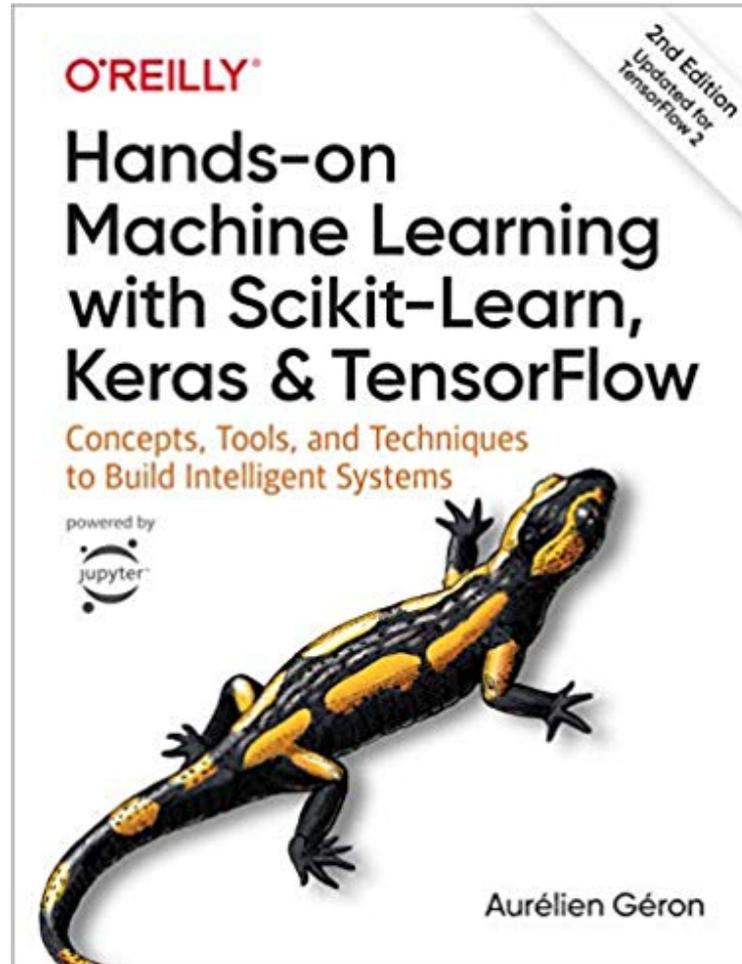


Source: Stuart Russell and Peter Norvig (2020), Artificial Intelligence: A Modern Approach, 4th Edition, Pearson

<https://www.amazon.com/Artificial-Intelligence-A-Modern-Approach/dp/0134610997/>

Aurélien Géron (2019),

**Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow:
Concepts, Tools, and Techniques to Build Intelligent Systems, 2nd Edition**
O'Reilly Media, 2019

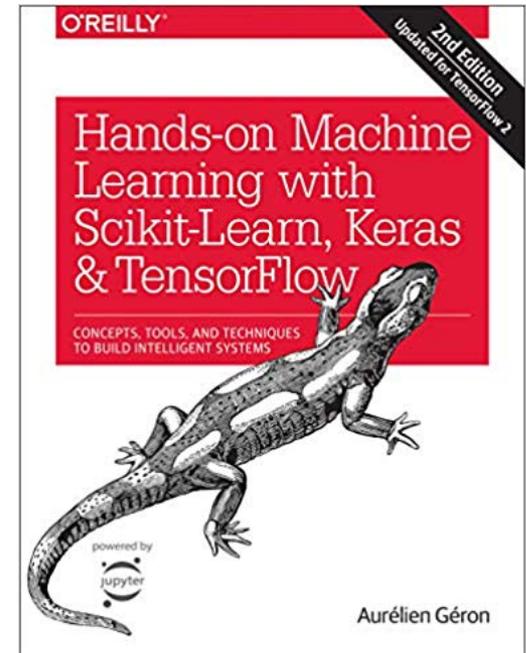


<https://github.com/ageron/handson-ml2>

Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow

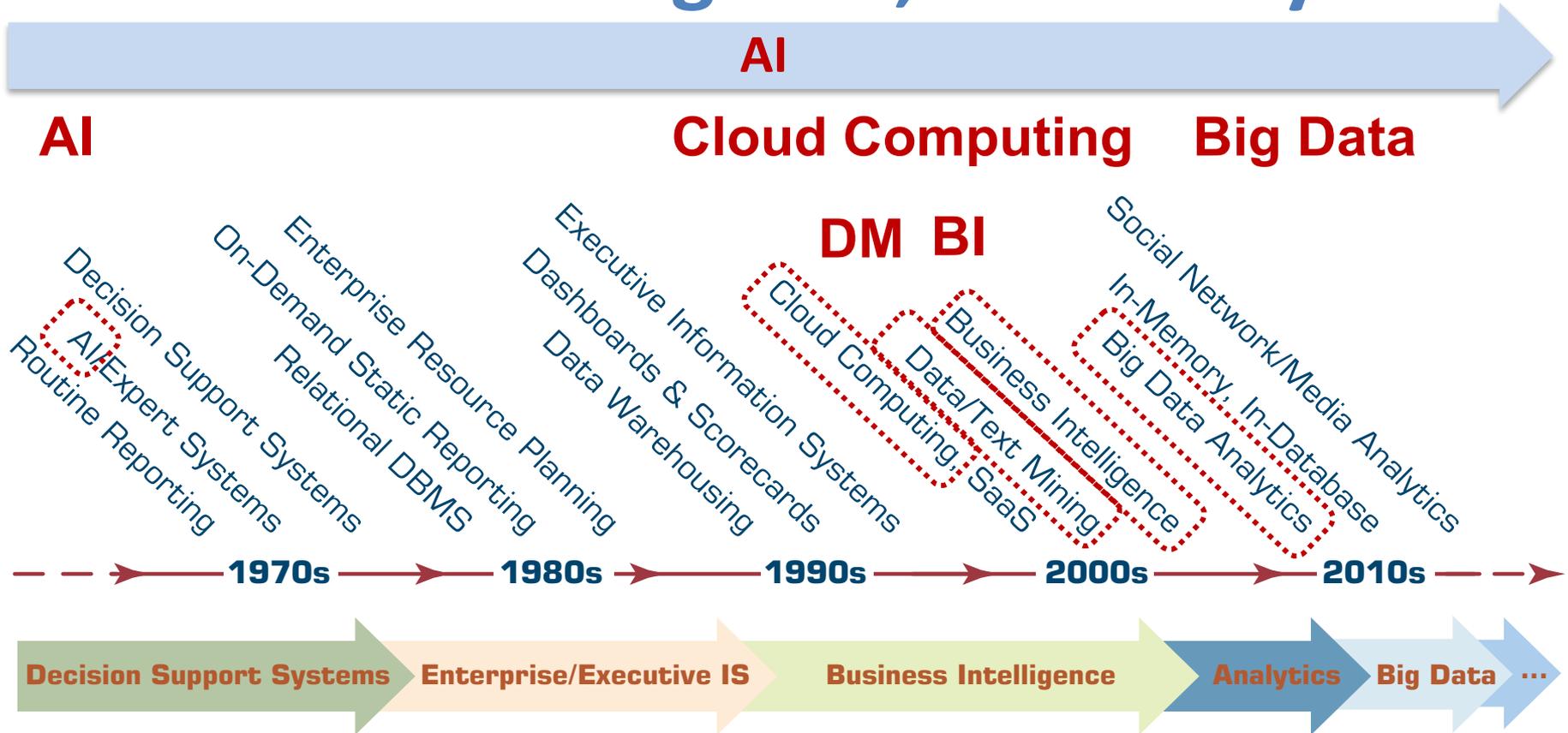
Notebooks

- [1. The Machine Learning landscape](#)
- [2. End-to-end Machine Learning project](#)
- [3. Classification](#)
- [4. Training Models](#)
- [5. Support Vector Machines](#)
- [6. Decision Trees](#)
- [7. Ensemble Learning and Random Forests](#)
- [8. Dimensionality Reduction](#)
- [9. Unsupervised Learning Techniques](#)
- [10. Artificial Neural Nets with Keras](#)
- [11. Training Deep Neural Networks](#)
- [12. Custom Models and Training with TensorFlow](#)
- [13. Loading and Preprocessing Data](#)
- [14. Deep Computer Vision Using Convolutional Neural Networks](#)
- [15. Processing Sequences Using RNNs and CNNs](#)
- [16. Natural Language Processing with RNNs and Attention](#)
- [17. Representation Learning Using Autoencoders](#)
- [18. Reinforcement Learning](#)
- [19. Training and Deploying TensorFlow Models at Scale](#)



AI, Big Data, Cloud Computing

Evolution of Decision Support, Business Intelligence, and Analytics



Artificial Intelligence (A.I.) Timeline

S/Z/Y/G/

A.I. TIMELINE

1950

TURING TEST

Computer scientist Alan Turing proposes a test for machine intelligence. If a machine can trick humans into thinking it is human, then it has intelligence

1955

A.I. BORN

Term 'artificial intelligence' is coined by computer scientist, John McCarthy to describe "the science and engineering of making intelligent machines"

1961

UNIMATE

First industrial robot, Unimate, goes to work at GM replacing humans on the assembly line

1964

ELIZA

Pioneering chatbot developed by Joseph Weizenbaum at MIT holds conversations with humans

1966

SHAKY

The 'first electronic person' from Stanford, Shakey is a general-purpose mobile robot that reasons about its own actions

A.I. WINTER

Many false starts and dead-ends leave A.I. out in the cold

1997

DEEP BLUE

Deep Blue, a chess-playing computer from IBM defeats world chess champion Garry Kasparov

1998

KISMET

Cynthia Breazeal at MIT introduces Kismet, an emotionally intelligent robot insofar as it detects and responds to people's feelings



1999

AIBO

Sony launches first consumer robot pet dog AIBO (AI robot) with skills and personality that develop over time



2002

ROOMBA

First mass produced autonomous robotic vacuum cleaner from iRobot learns to navigate and clean homes



2011

SIRI

Apple integrates Siri, an intelligent virtual assistant with a voice interface, into the iPhone 4S



2011

WATSON

IBM's question answering computer Watson wins first place on popular \$1M prize television quiz show Jeopardy



2014

EUGENE

Eugene Goostman, a chatbot passes the Turing Test with a third of judges believing Eugene is human



2014

ALEXA

Amazon launches Alexa, an intelligent virtual assistant with a voice interface that completes shopping tasks



2016

TAY

Microsoft's chatbot Tay goes rogue on social media making inflammatory and offensive racist comments

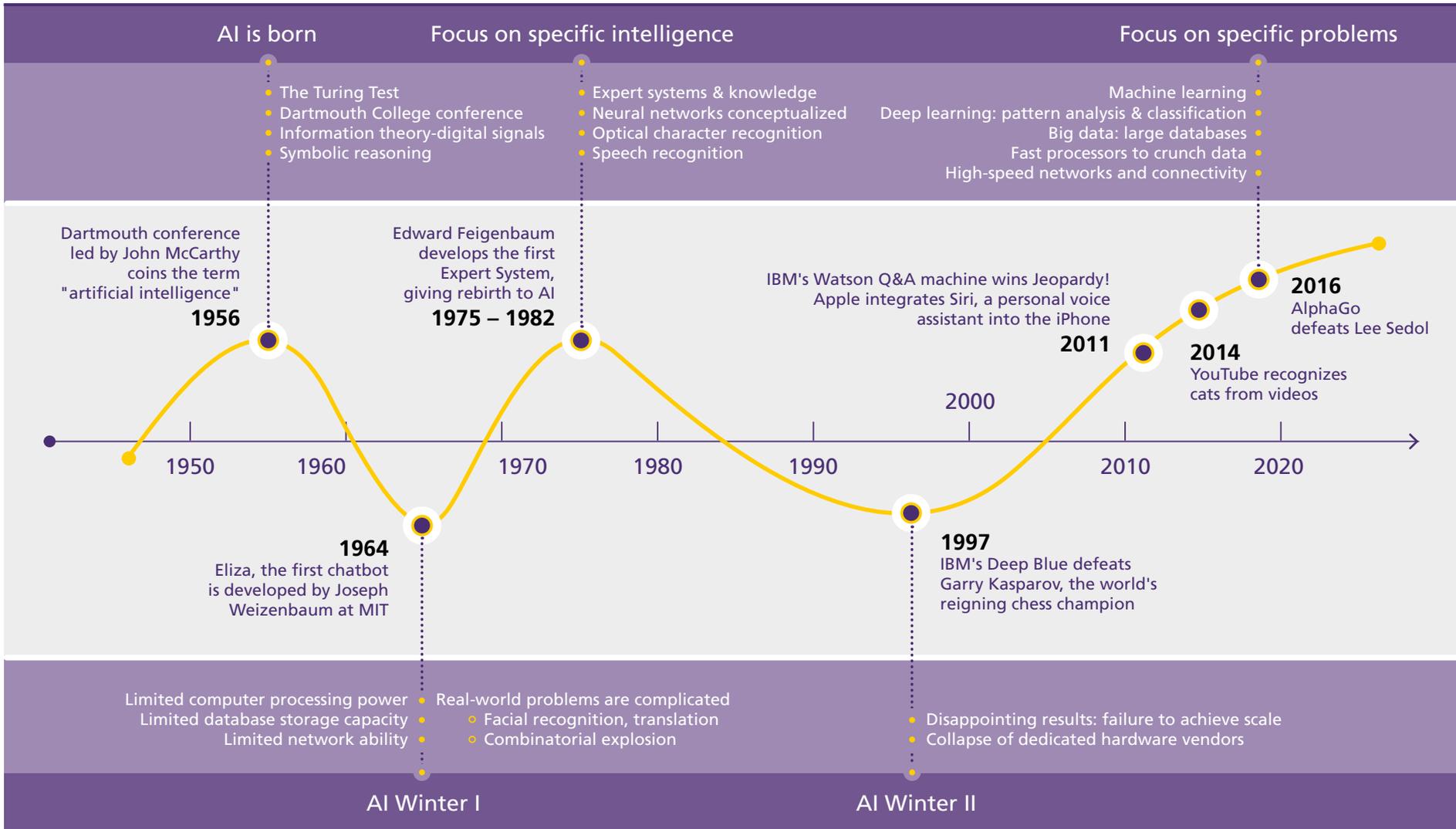


2017

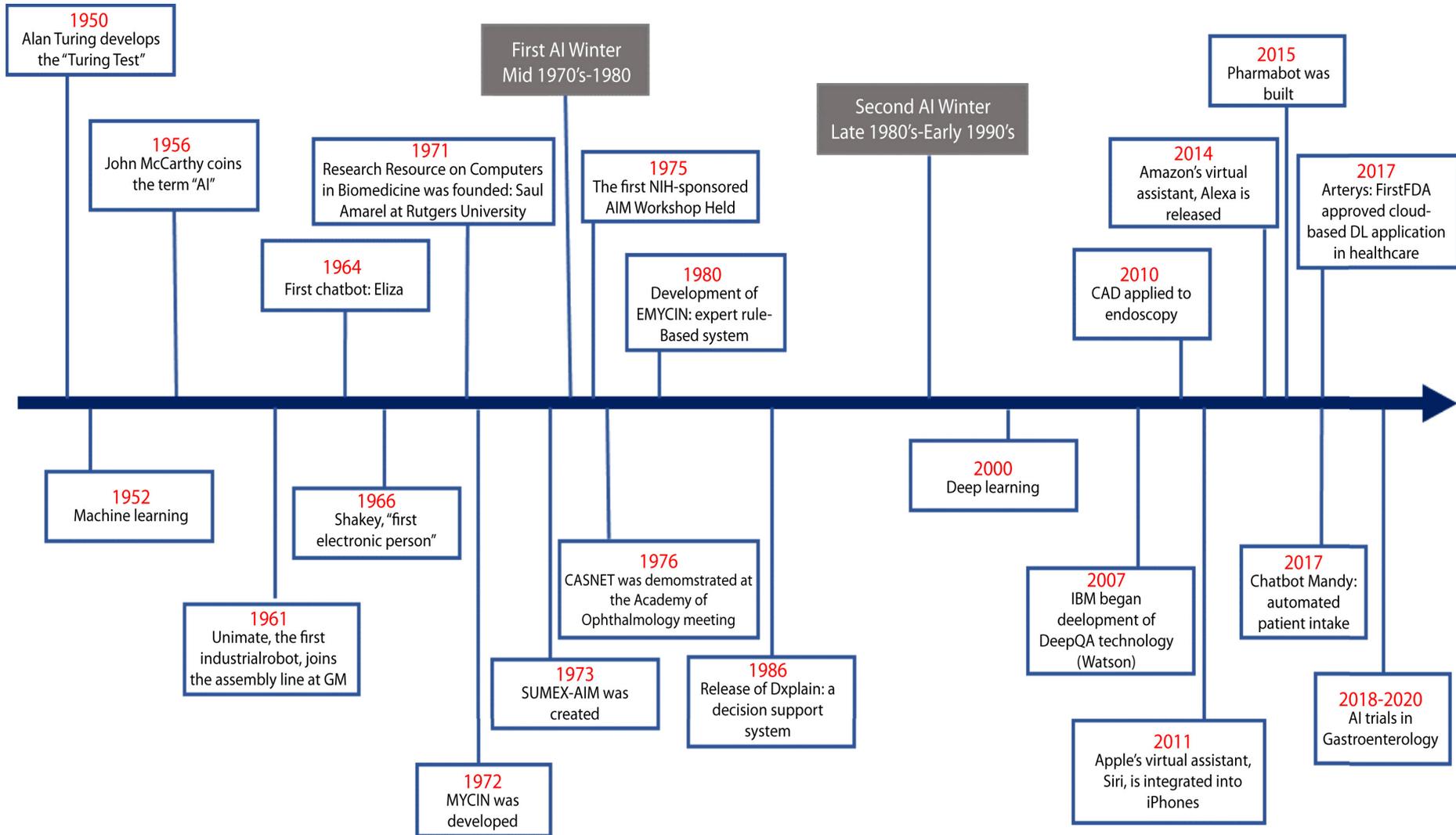
ALPHAGO

Google's A.I. AlphaGo beats world champion Ke Jie in the complex board game of Go, notable for its vast number (2^{170}) of possible positions

The Rise of AI



Artificial Intelligence in Medicine



AI

Definition of Artificial Intelligence (A.I.)

Artificial Intelligence

**“... the science and
engineering
of
making
intelligent machines”
(John McCarthy, 1955)**

Artificial Intelligence

**“... technology that
thinks and acts
like humans”**

Artificial Intelligence

**“... intelligence
exhibited by machines
or software”**

4 Approaches of AI

| | |
|-------------------------|----------------------------|
| Thinking Humanly | Thinking Rationally |
| Acting Humanly | Acting Rationally |

4 Approaches of AI

2.

**Thinking Humanly:
The Cognitive
Modeling Approach**

3.

**Thinking Rationally:
The “Laws of Thought”
Approach**

1.

**Acting Humanly:
The Turing Test
Approach** (1950)

4.

**Acting Rationally:
The Rational Agent
Approach**

AI Acting Humanly: The Turing Test Approach (Alan Turing, 1950)

- Knowledge Representation
- Automated Reasoning
- Machine Learning (ML)
 - Deep Learning (DL)
- Computer Vision (Image, Video)
- Natural Language Processing (NLP)
- Robotics

Artificial Intelligence: A Modern Approach

1. Artificial Intelligence
2. Problem Solving
3. Knowledge and Reasoning
4. Uncertain Knowledge and Reasoning
5. Machine Learning
6. Communicating, Perceiving, and Acting
7. Philosophy and Ethics of AI

Artificial Intelligence: Intelligent Agents

Artificial Intelligence:

2. Problem Solving

- Solving Problems by Searching
- Search in Complex Environments
- Adversarial Search and Games
- Constraint Satisfaction Problems

Artificial Intelligence:

3. Knowledge and Reasoning

- Logical Agents
- First-Order Logic
- Inference in First-Order Logic
- Knowledge Representation
- Automated Planning

Artificial Intelligence:

4. Uncertain Knowledge and Reasoning

- Quantifying Uncertainty
- Probabilistic Reasoning
- Probabilistic Reasoning over Time
- Probabilistic Programming
- Making Simple Decisions
- Making Complex Decisions
- Multiagent Decision Making

Artificial Intelligence:

5. Machine Learning

- Learning from Examples
- Learning Probabilistic Models
- Deep Learning
- Reinforcement Learning

Artificial Intelligence:

6. Communicating, Perceiving, and Acting

- Natural Language Processing
- Deep Learning for Natural Language Processing
- Computer Vision
- Robotics

Artificial Intelligence:

Philosophy and Ethics of AI

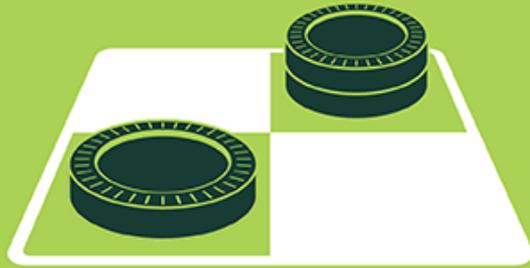
The Future of AI

Artificial Intelligence

Machine Learning & Deep Learning

ARTIFICIAL INTELLIGENCE

Early artificial intelligence stirs excitement.



MACHINE LEARNING

Machine learning begins to flourish.



DEEP LEARNING

Deep learning breakthroughs drive AI boom.



1950's

1960's

1970's

1980's

1990's

2000's

2010's

Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.

AI, ML, DL

Artificial Intelligence (AI)

Machine Learning (ML)

Supervised
Learning

Unsupervised
Learning

Deep Learning (DL)

CNN

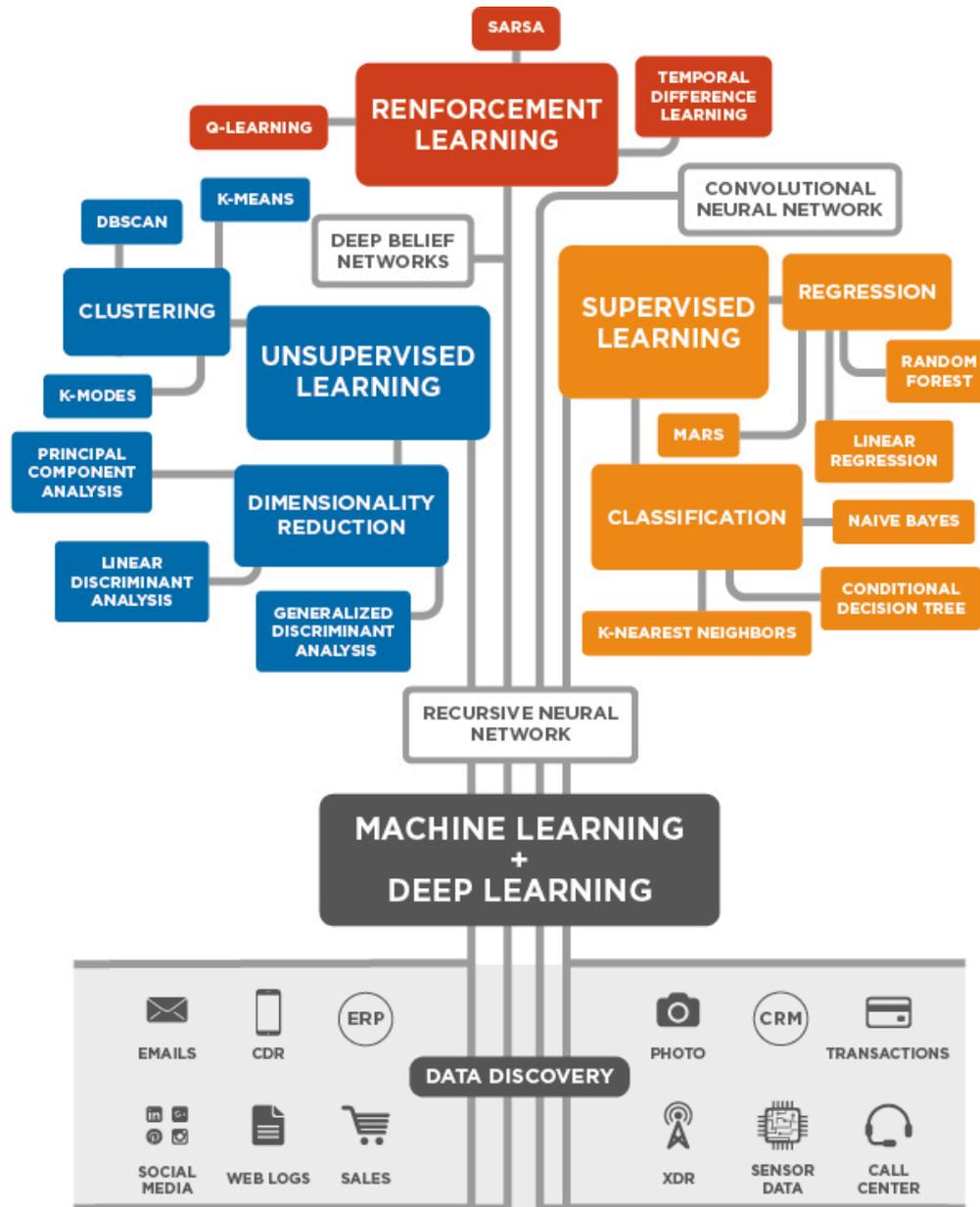
RNN LSTM GRU

GAN

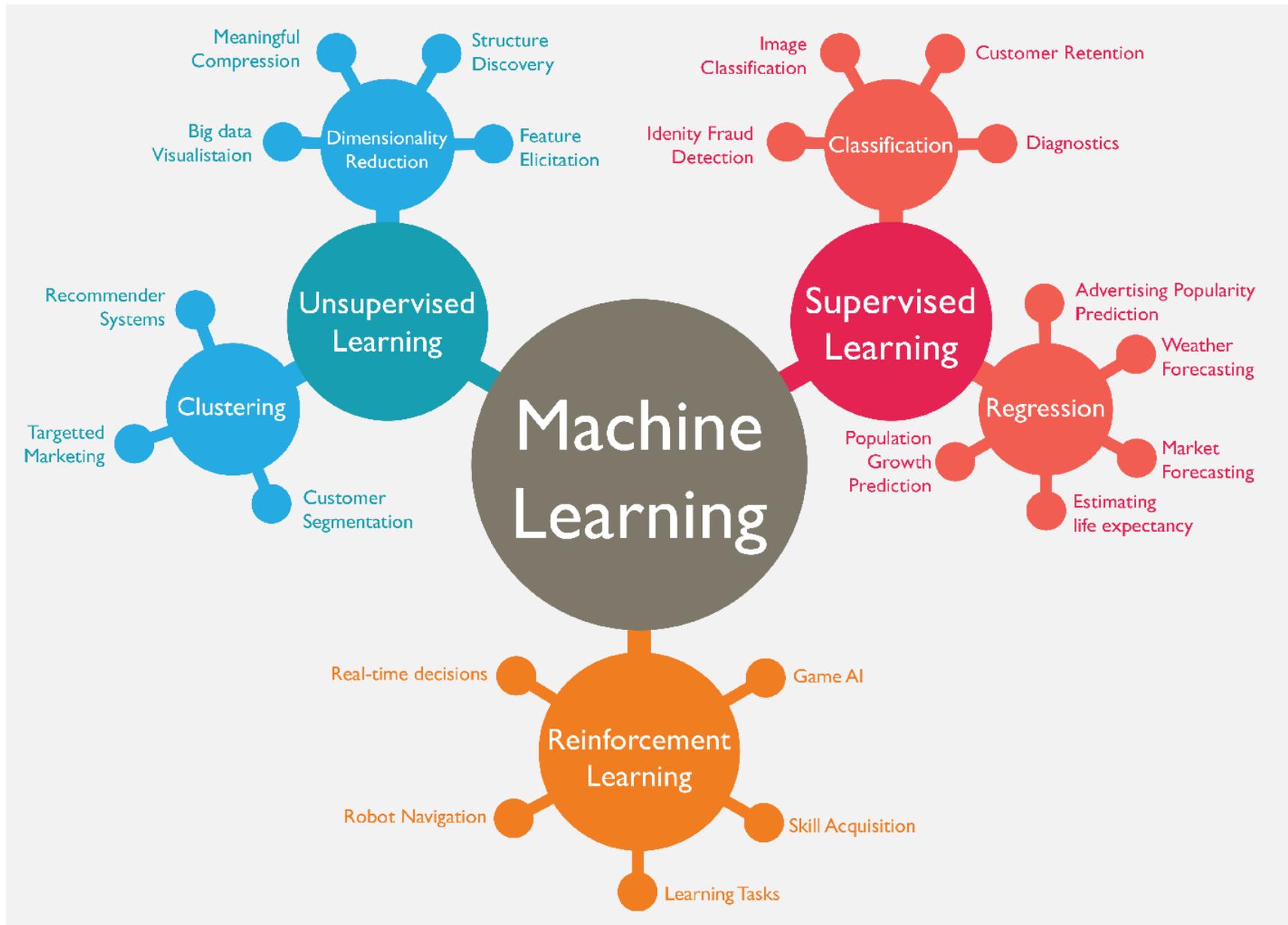
Semi-supervised
Learning

Reinforcement
Learning

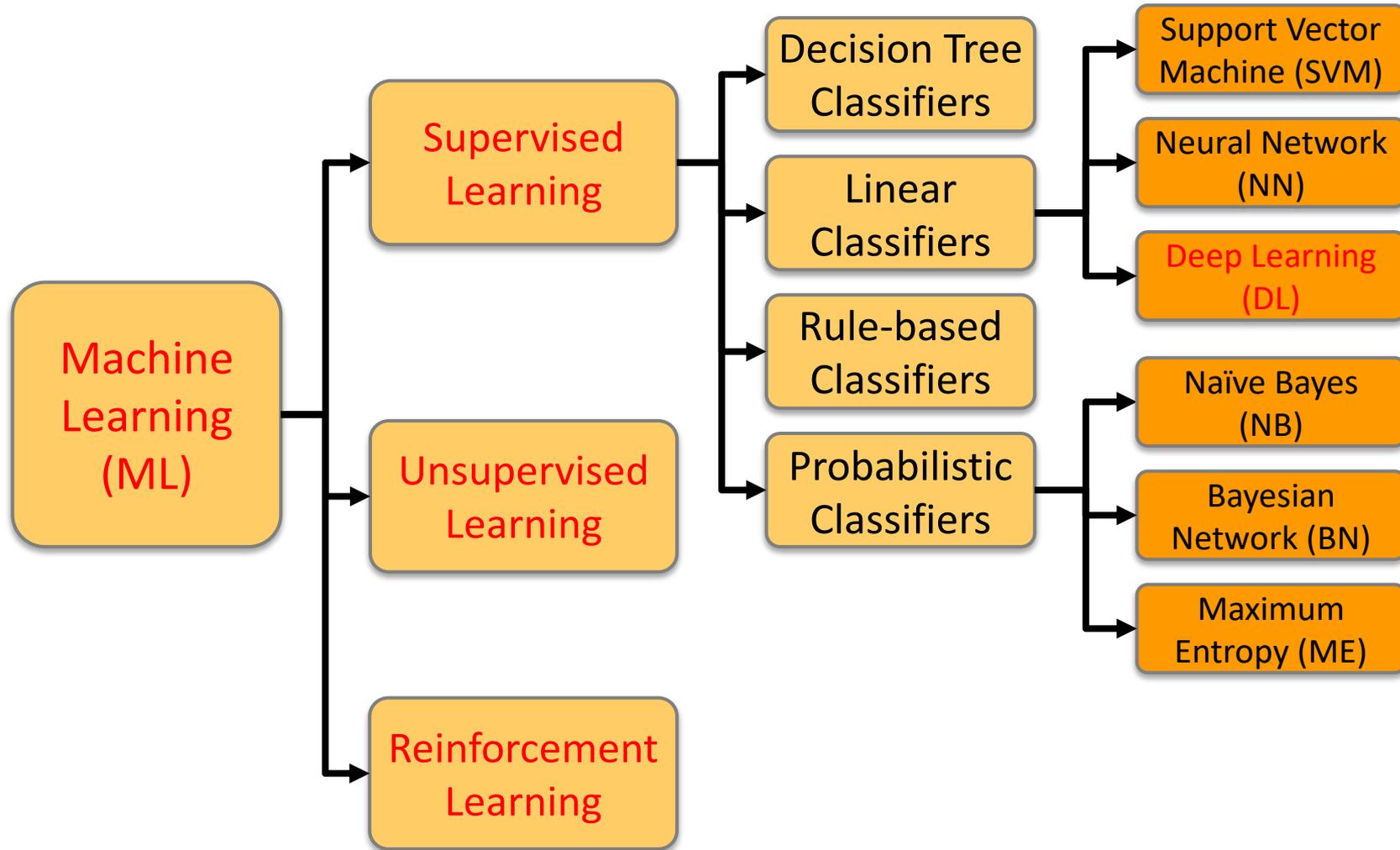
3 Machine Learning Algorithms



Machine Learning (ML)



Machine Learning (ML) / Deep Learning (DL)



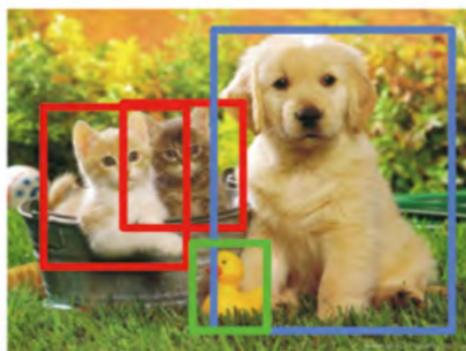
Computer Vision: Image Classification, Object Detection, Object Instance Segmentation

Classification

Classification
+ Localization

Object
Detection

Instance
Segmentation



CAT

CAT

CAT, DOG, DUCK

CAT, DOG, DUCK

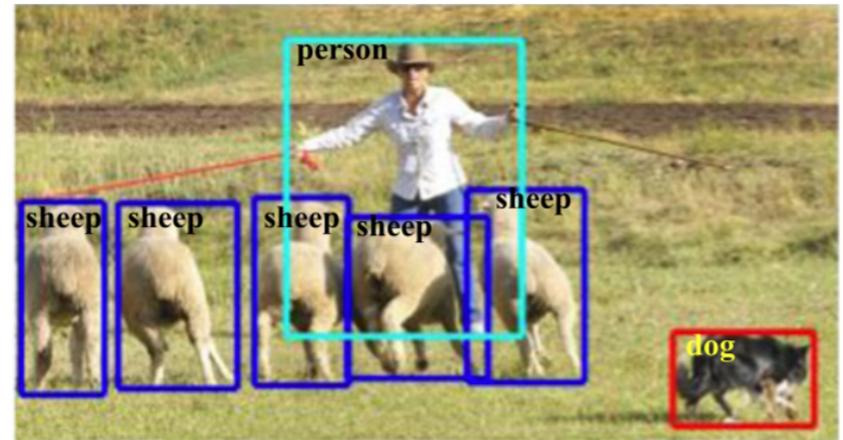
Single Objects

Multiple Objects

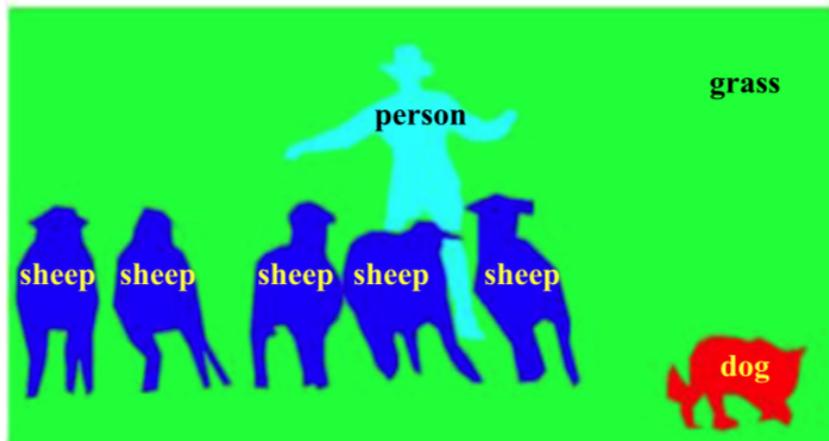
Computer Vision: Object Detection



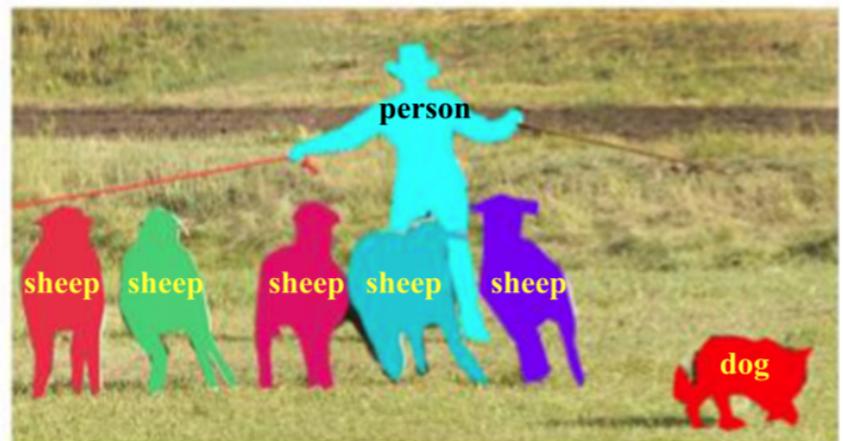
(a) Object Classification



(b) Generic Object Detection (Bounding Box)



(c) Semantic Segmentation

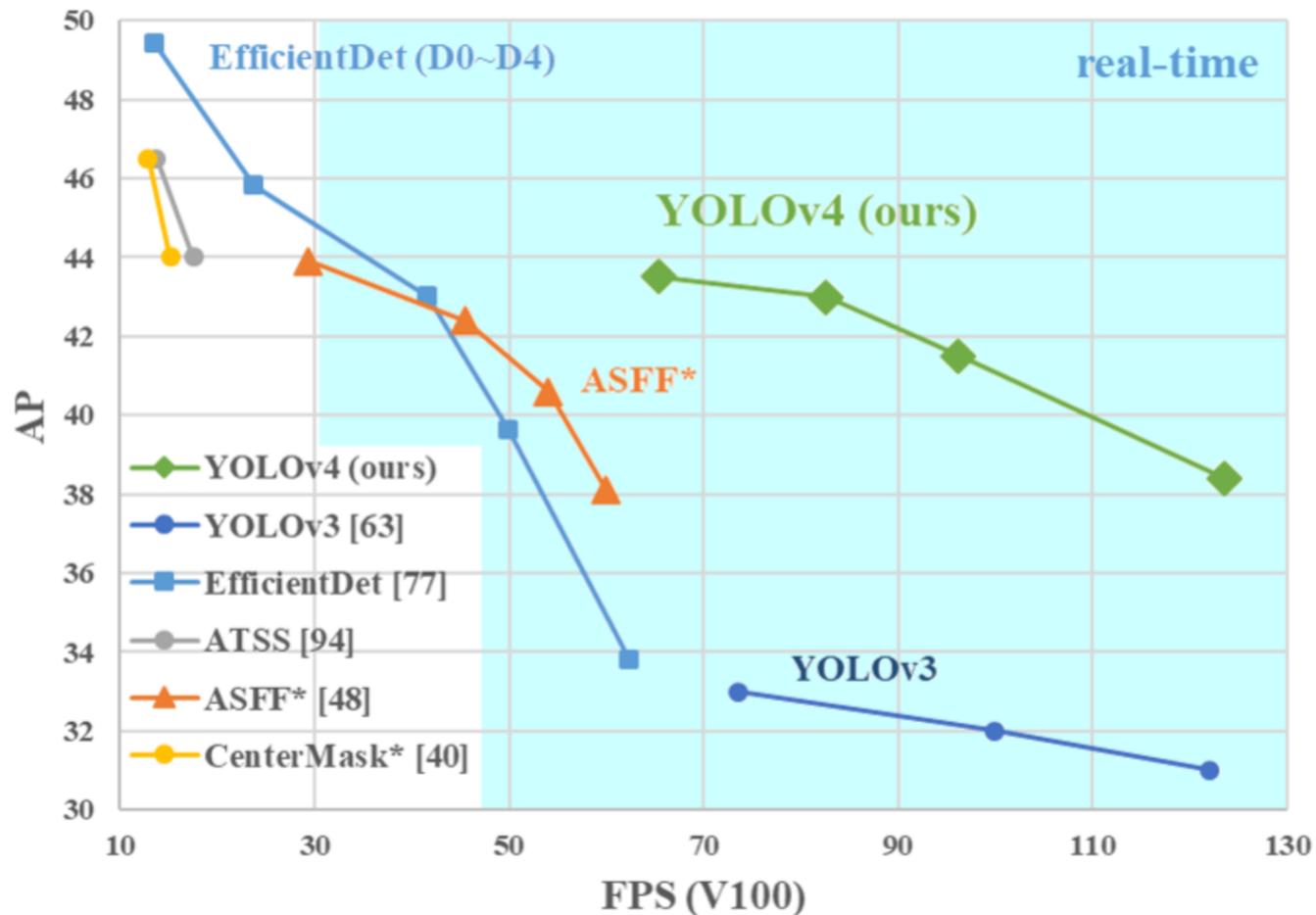


(d) Object Instance Segmentation

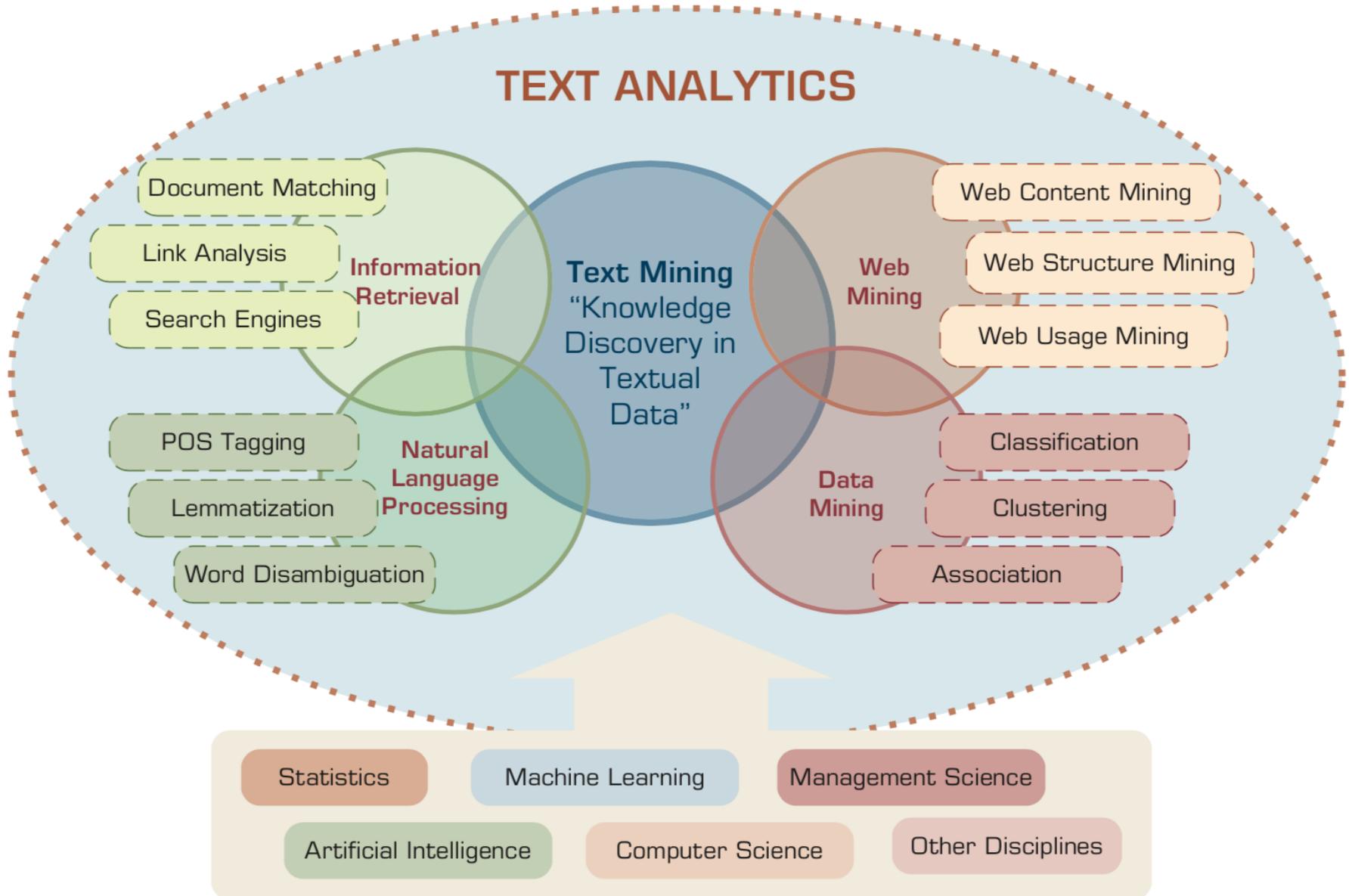
YOLOv4:

Optimal Speed and Accuracy of Object Detection

MS COCO Object Detection



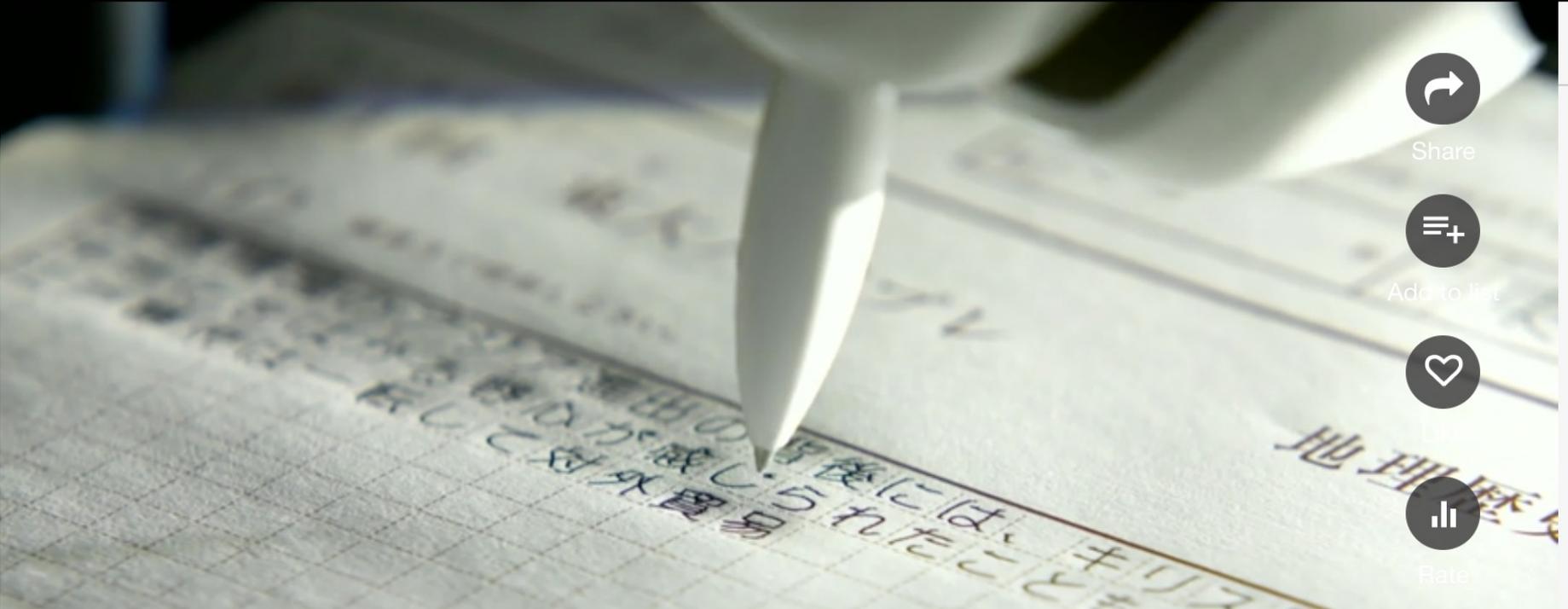
Text Analytics and Text Mining



Can a robot pass a university entrance exam?

Noriko Arai at TED2017

TED Ideas worth spreading WATCH DISCOVER ATT



Noriko Arai at TED2017

Can a robot pass a university entrance exam?

Share Add to list Like Rate

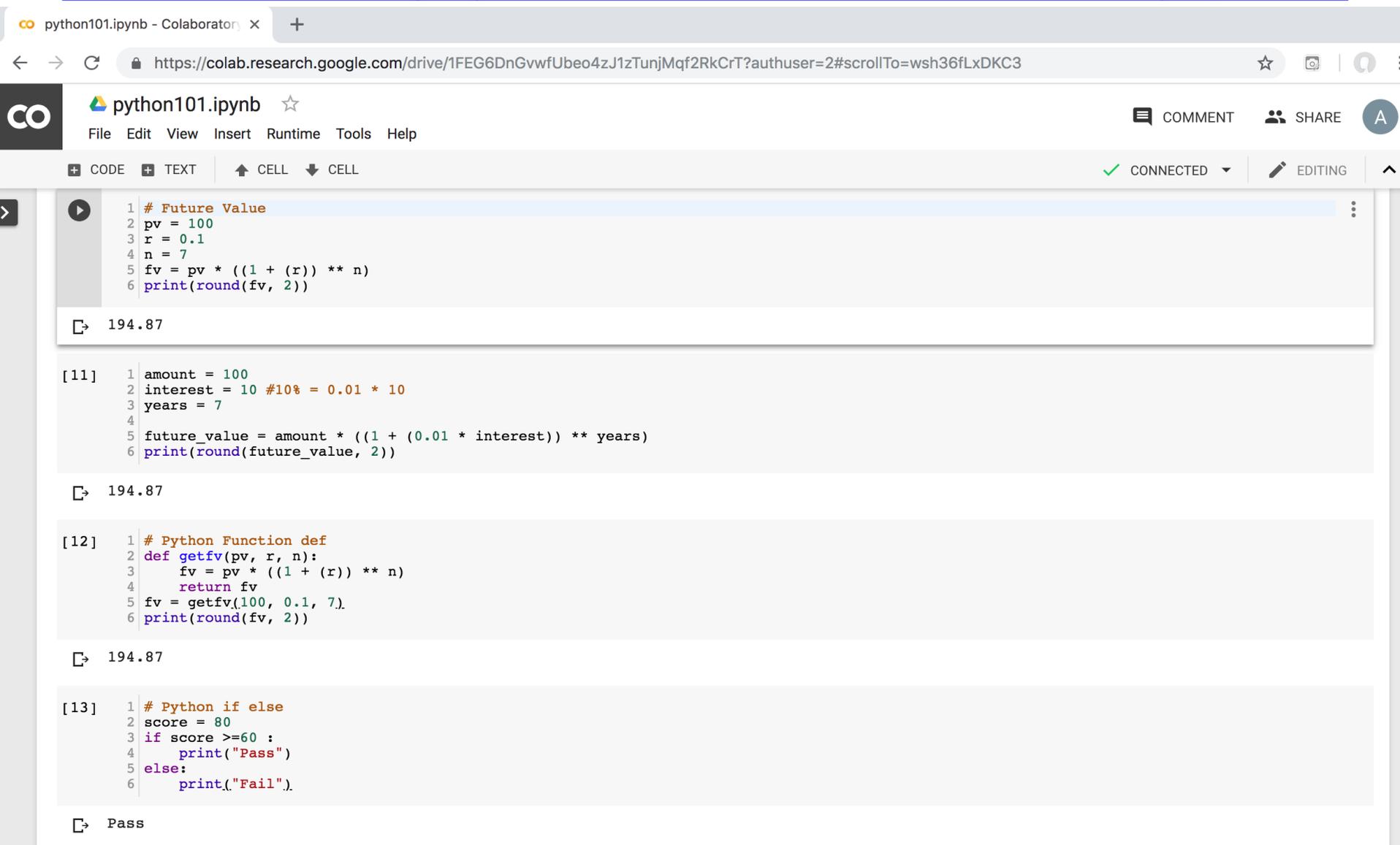
11:25

https://www.ted.com/talks/noriko_arai_can_a_robot_pass_a_university_entrance_exam

<https://www.youtube.com/watch?v=XQZjkPyJ8KU>

Python in Google Colab (Python101)

<https://colab.research.google.com/drive/1FEG6DnGvwfUbeo4zJ1zTunjMqf2RkCrT>



The screenshot shows a Google Colab notebook with the following content:

- Cell 1:** Python code to calculate the future value of an investment.

```
1 # Future Value
2 pv = 100
3 r = 0.1
4 n = 7
5 fv = pv * ((1 + (r)) ** n)
6 print(round(fv, 2))
```

Output: 194.87
- Cell 2:** Python code to calculate the future value with an interest rate.

```
11] 1 amount = 100
2 interest = 10 #10% = 0.01 * 10
3 years = 7
4
5 future_value = amount * ((1 + (0.01 * interest)) ** years)
6 print(round(future_value, 2))
```

Output: 194.87
- Cell 3:** Python code defining a function to calculate future value.

```
12] 1 # Python Function def
2 def getfv(pv, r, n):
3     fv = pv * ((1 + (r)) ** n)
4     return fv
5 fv = getfv(100, 0.1, 7)
6 print(round(fv, 2))
```

Output: 194.87
- Cell 4:** Python code using an if-else statement to check a score.

```
13] 1 # Python if else
2 score = 80
3 if score >=60 :
4     print("Pass")
5 else:
6     print("Fail").
```

Output: Pass

<https://tinyurl.com/aintpupython101>

Summary

- This course introduces the **fundamental concepts**, **research issues**, and **hands-on practices** of **Artificial Intelligence**.
- Topics include
 1. Introduction to Artificial Intelligence
 2. Artificial Intelligence and Intelligent Agents
 3. Problem Solving
 4. Knowledge, Reasoning and Knowledge Representation, Uncertain Knowledge and Reasoning
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人工智慧

(Artificial Intelligence)

Contact Information



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Accredited
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Solutions
Architect

Associate

aws
certified

Cloud
Practitioner

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