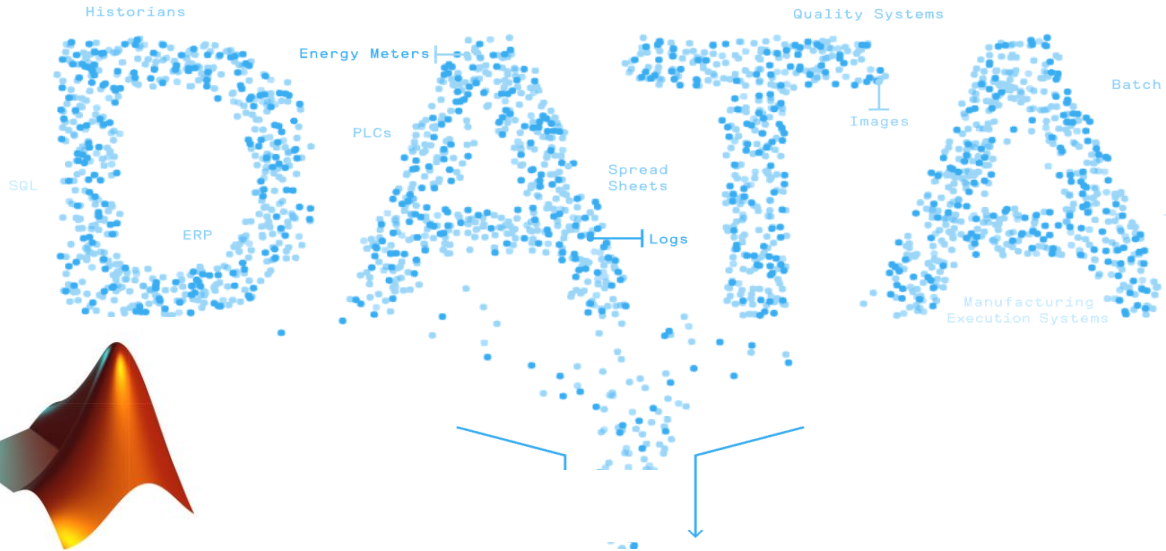
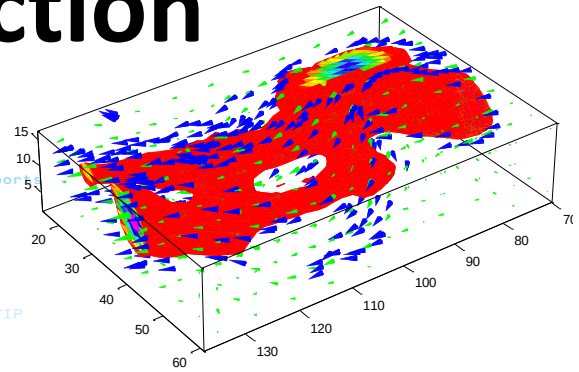
Introduction to Artificial Intelligence

- 01-08-02 An Introduction





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21/Feb/2024

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7. AI Applications
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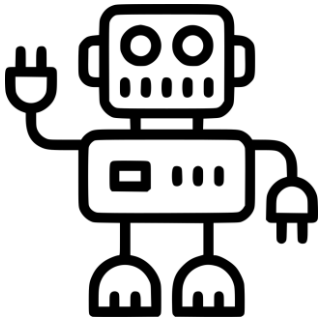

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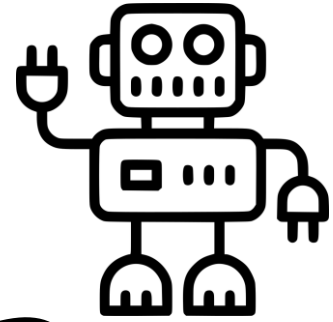

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- 5.3 Fuzzy Logic
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- 5.5 AI Ethics
- 5.6 Reports, Courses and Others

5.0 Reading List – AI

[1] Gathering Strength, Gathering Storms: **The One Hundred Year Study on Artificial Intelligence (AI100) 2021 Study Panel Report**. Stanford University, Stanford, CA, September 2021. Doc: http://ai100.stanford.edu/2021-report. Accessed: September 16, 2021.

[2] 徐宗本. 人工智能的10个重大数理基础问题. 中国科学: 信息科学, 2021, 51: 1967–1978 https://mp.weixin.qq.com/s/VAv2gzxl75vQLXsS_VcGEw

[3] AI Index Report, https://aiindex.stanford.edu/report/

[4] https://github.com/KaiyuanGao/AI-Surveys

5.1 Reading List – Evolutionary Computation

[1] Goldberg, D.E. 1989. Genetic Algorithms in Search, Optimization and Machine Learning. Addison-Wesley Publishing Company, Boston, MA, USA

[2] Holland, J.J. 1992. Genetic algorithm. Scientific American Magazine, pp. 44–5

[3] Michalewicz, Z. 1996. Genetic Algorithm + Data Structures = Evolution Programs (3rd ed.). Springer-Verlag, New York, USA

[4] Mitsuo Gen, Runwei Cheng, Genetic Algorithms and Engineering Optimization, Wiley Series in Engineering Design and Automation, 2000, John Wiley & Sons

5.2 Reading List – Artificial Neural Network

[1] 邱锡鹏,神经网络与深度学习(Neural Networks and Deep Learning), https://nndl.github.io/

[2] Michael Nielsen, Neural Networks and Deep Learning, http://neuralnetworksanddeeplearning.com/

[3] Machine Learning with MATLAB (PDF version), https://www.mathworks.com/content/dam/mathworks/ebook/gated/machine-Learning-ebook.pdf

[4] Statistical learning methods, 统计学习方法(第2版)[李航] [笔记, 代码, notebook, 参考文献, Errata, lihang], https://github.com/SmirkCao/Lihang

[5] Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong, Mathematics for Machine Learning, https://mml-book.github.io/

[6] 周志华，机器学习，清华大学出版社

5.2 Reading List – Artificial Neural Network

[7] **动手学深度学习**, 2020 年 05月08日， https://zh.d2l.ai

[8] **Deep Reinforcement Learning,** CS 285 at UC Berkeley, http://rail.eecs.berkeley.edu/deeprlcourse/

[9] 吴恩达, deeplearning.ai

[10] 李宏毅, 一天搞懂深度学习

[11] **深度学习框架的来龙去脉**

https://zhuanlan.zhihu.com/p/59086302

[12] PyTorch vs Tensorflow for Your Python Deep Learning Project

https://realpython.com/pytorch-vs-tensorflow/

[13] Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep learning. MIT press.

http://www.deeplearningbook.org/

5.2 Reading List – Artificial Neural Network

[14] NYU Deep Learning Spring 2021 (NYU-DLSP21)

[15] https://cds.nyu.edu/deep-learning/

[16] https://www.youtube.com/watch?v=mTtDfKgLm54

[17] https://atcold.github.io/pytorch-Deep-Learning/zh/

[18] https://github.com/Atcold/NYU-DLSP21

[19] https://atcold.github.io/NYU-DLSP21/

[20] https://www.reddit.com/r/NYU_DeepLearning/

[21] https://github.com/eugeneyan/ml-surveys

神经网络与深度学习 (邱锡鹏，复旦大学)

- 第 1 章是绪论，介绍人工智能、机器学习、深度学习的概要，使读者对相关知识进行全面的了解。
- 第 2、3 章介绍了机器学习的基础知识。
- 第 4、5、6 章分别讲述三种主要的神经网络模型：前馈神经网络、卷积神经网络和循环神经网络。在第 6 章中略提了下图网络的内容。
- 第 7 章介绍神经网络的优化与正则化方法。
- 第 8 章介绍神经网络中的注意力机制和外部记忆。
- 第 9 章简要介绍了一些无监督学习方法。
- 第 10 章中介绍一些和模型独立的机器学习方法：集成学习、协同学习、多任务学习、迁移学习、终生学习、小样本学习、元学习等。这些都是目前深度学习的难点和热点问题。
- 第 11 章介绍了概率图模型的基本概念，为后面的章节进行铺垫。
- 第 12 章介绍两种早期的深度学习模型：玻尔兹曼机和深度信念网络。
- 第 13 章介绍最近两年发展十分迅速的深度生成模型：变分自编码器和对抗生成网络。
- 第 14 章介绍了深度强化学习的知识。
- 第 15 章介绍了应用十分广泛的序列生成模型。

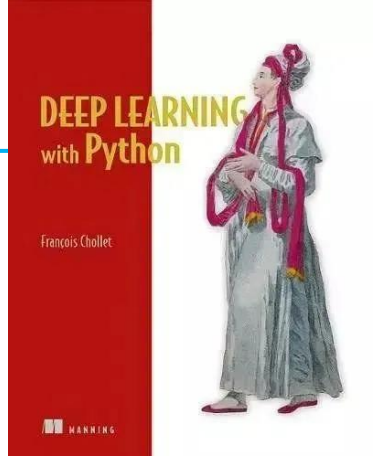
4 books for beginner

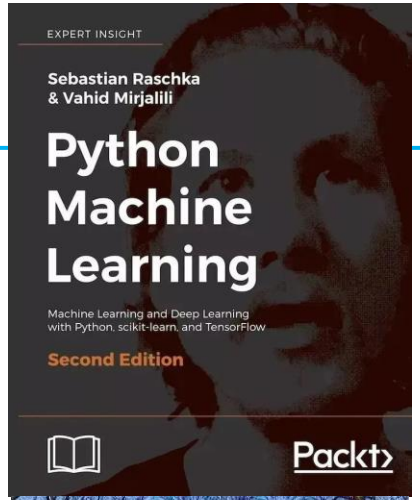
1. Deep Learning with Python
https://github.com/fchollet/deep-learning-with-python-notebooks

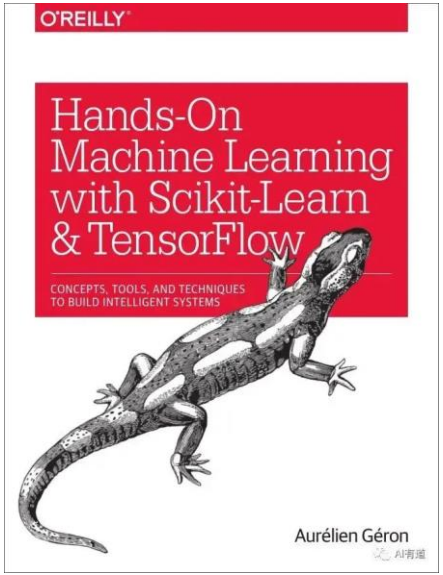
2. Python Machine Learning
https://github.com/rasbt/python-machine-learning-book-2nd-edition

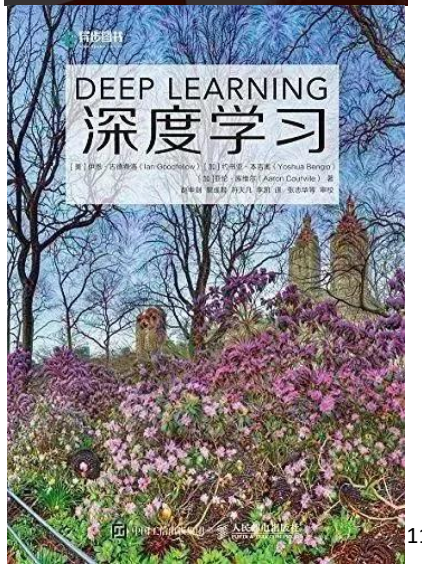
3. Hands-On Machine Learning with Scikit-Learn & TensorFlow
https://github.com/ageron/handson-ml

4. Deep Learning









5.3 Reading List – Fuzzy Logic

[1] Zadeh, L.A. 2008. Is there a need for fuzzy logic? Information Sciences 178: 2751–2779.

[2] Zadeh, L.A. 1965. Fuzzy Sets. Information and Control 8: 338–353, https://www.sciencedirect.com/science/article/pii/S001999586590241X

5.4 Hyperparameter Tuning

[1] Hyperparameter Tuning in Python: a Complete Guide 2021

https://neptune.ai/blog/best-tools-for-model-tuning-and-hyperparameter-optimization

[2] Best Tools for Model Tuning and Hyperparameter Optimization

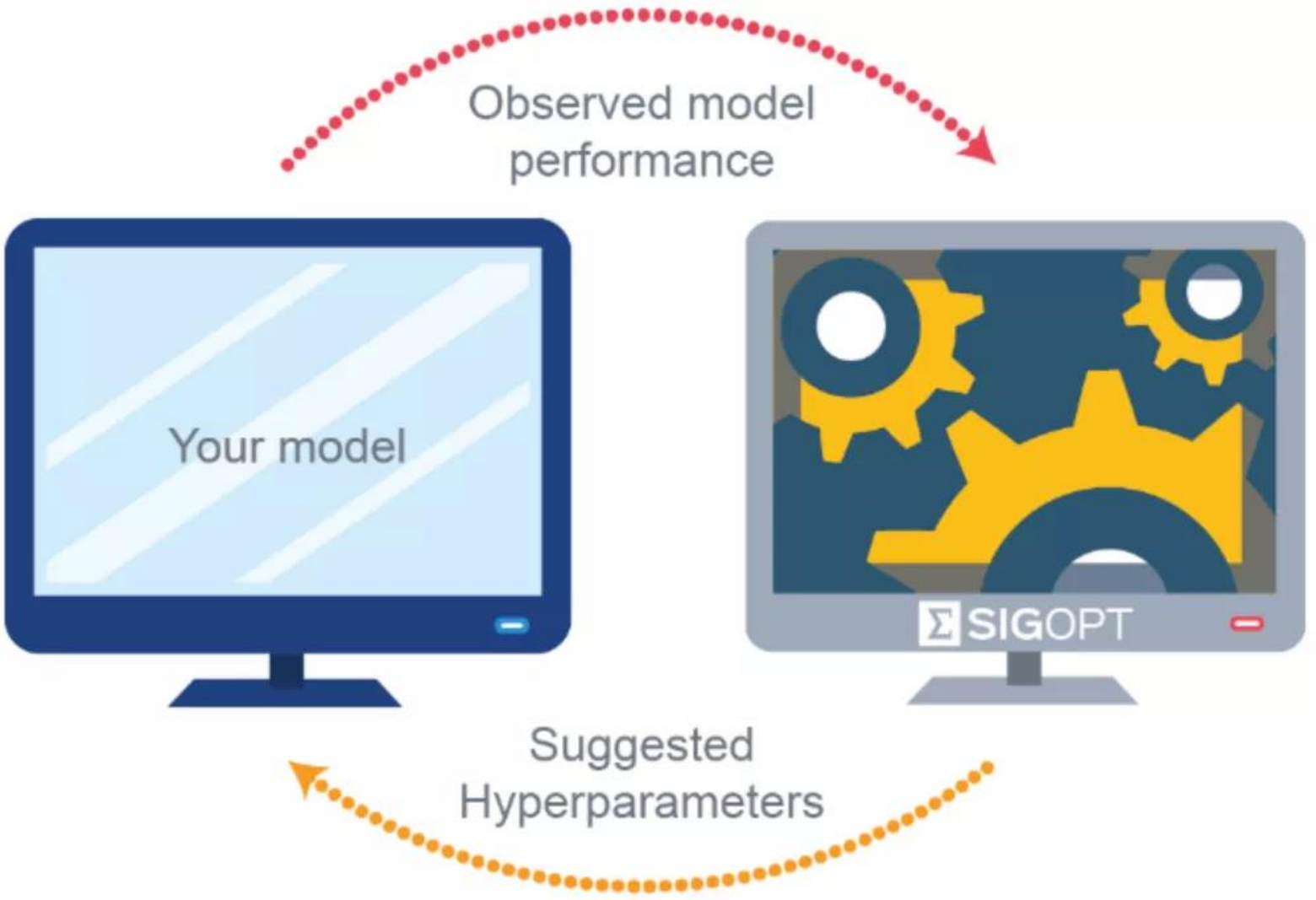
https://neptune.ai/blog/best-tools-for-model-tuning-and-hyperparameter-optimization

[3] **Hyper-Parameter Optimization: A Review of Algorithms and Applications**

https://arxiv.org/abs/2003.05689

[4] **Hyperparameter Optimization: Foundations, Algorithms, Best Practices and Open Challenges**

https://arxiv.org/abs/2107.05847


Observed model performance
Your model
SIGOPT
Suggested Hyperparameters

Algos	Hyper Parameters			
	Most used	**Others**	**Range**	**Purpose**
Decision Tree classifier	1. max_depth (def = 1)	2. Criterion 3. max_features 4. max_leaf_nodes 5. min_sample_leaf	1. 1 to as many 2. Two options "Gini", "Entropy" 3. 1 – number of features 4. 1 to as many 5. 1 to as many	1. Number of levels allowed in the DT model 2. Metric to capture information gain 3. Number of features to evaluate to split 4. Number of leaf nodes allowed 5. Define smallest leaf size in terms of number of data points in the leaf
Random Forest	1. N_estimators (Default = 100)	2. Criterion 3. Max_depth 4. Max_features 5. bootstrap	1. Same as above 2. Same as above 3. Same as above 4. Yes /No	1. Number of instances in the ensemble 2. Metric to capture information gain 3. Number of features to evaluate 4. Whether to use bootstrap sampling (default = Yes)
Logistic Regression	1. C (default = 1)	2. fit_intercept (Default True) 3.Solver (default = "lbfgs")	1. As per req 2. True / False 3. Options include 'newton-cg', 'lbfgs', 'liblinear', 'sag', 'saga'	1. Penalize large coefficients 2. To remove intercept from the model if required 3. To minimize the error function

5.5 AI Ethics

[1] China: A New Generation of Artificial Intelligence Ethics Guidelines (2021) 新一代人工智能伦理规范

http://www.most.gov.cn/kjbgz/202109/t20210926_177063.html

中华人民共和国科学技术部
Ministry of Science and Technology of the People's Republic of China

[2] EU: Ethics guidelines for trustworthy AI (2019)

https://ec.europa.eu/digital-single-market/en/news/ethics-guidelines-trustworthy-ai

[3] UK: Data ethics and AI guidance landscape

https://www.gov.uk/guidance/data-ethics-and-ai-guidance-landscape

[4]UK: Understanding artificial intelligence ethics and safety

https://www.gov.uk/guidance/understanding-artificial-intelligence-ethics-and-safety

5.5 AI Ethics

[5] **UK government publishes pioneering standard for algorithmic transparency**

https://www.gov.uk/government/news/uk-government-publishes-pioneering-standard-for-algorithmic-transparency

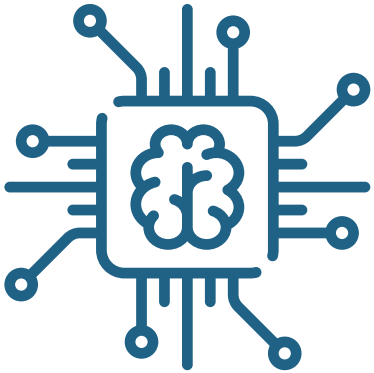
[6] UK: Understanding artificial intelligence ethics and safety - A guide to AI ethics, including responsible design and implementation of AI systems in the public sector

https://www.turing.ac.uk/research/publications/understanding-artificial-intelligence-ethics-and-safety

5.6 Reports, Courses and Others

[1] **AI-generated characters for supporting personalized learning and well-being**

Nature Machine Intelligence **volume 3**, pages 1013–1022 (2021)
https://www.nature.com/articles/s42256-021-00417-9



[2] Data Science Infographic

https://github.com/dataprofessor/infographic

[3] AI-Expert-Roadmap

https://github.com/AMAI-GmbH/AI-Expert-Roadmap

[4] The courses are free, and you can now earn certificates

https://www.kaggle.com/learn

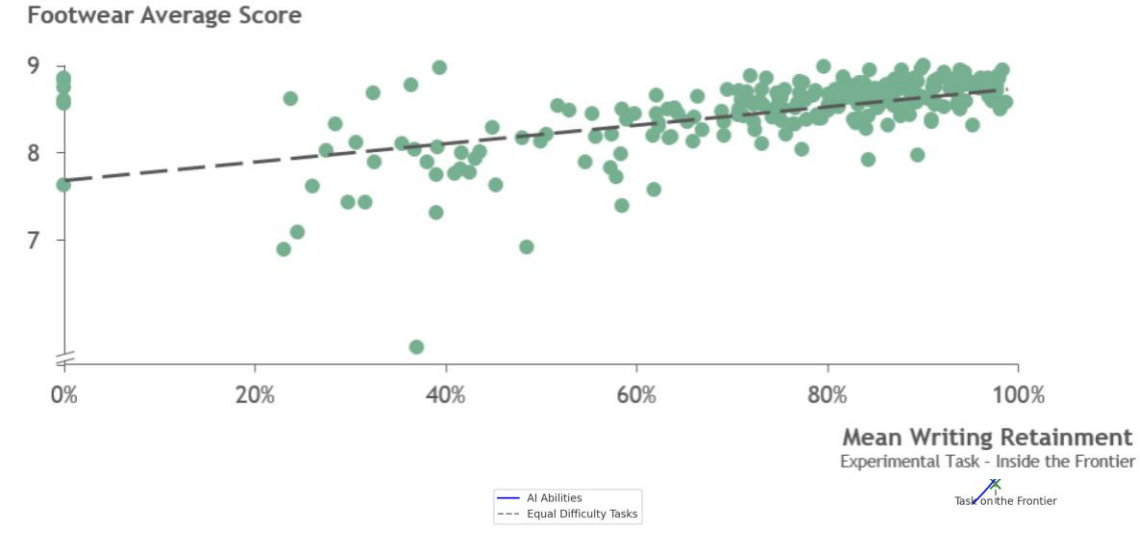
[5] State of AI Report 2022, stateof.ai

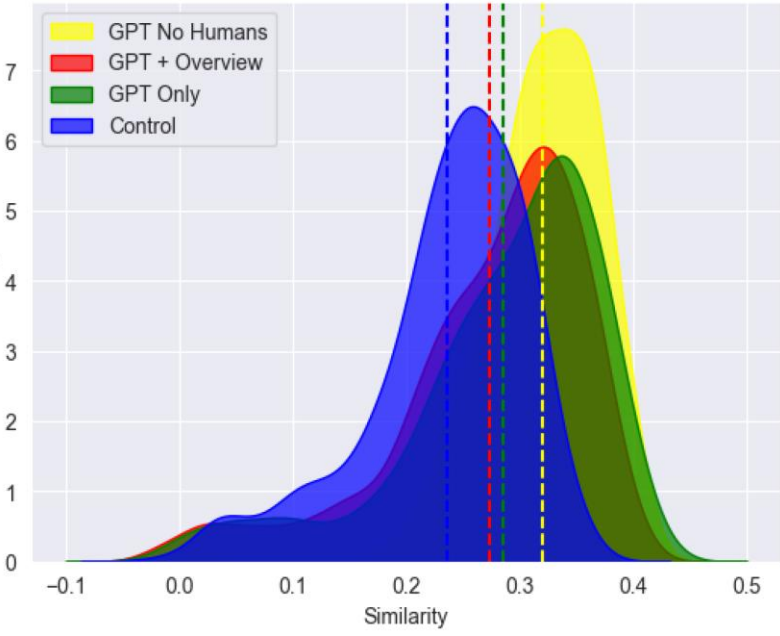
[6] https://setosa.io/ev/ Explained Visually (EV) is an experiment in making hard ideas intuitive inspired the work of Bret Victor's Explorable Explanations.

5.6 Reports, Courses and Others

[7] **Navigating the Jagged Technological Frontier: Field Experimental Evidence of the Effects of AI on Knowledge Worker Productivity and Quality**, Harvard Business School Technology & Operations Mgt. Unit Working Paper No. 24-013

https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4573321

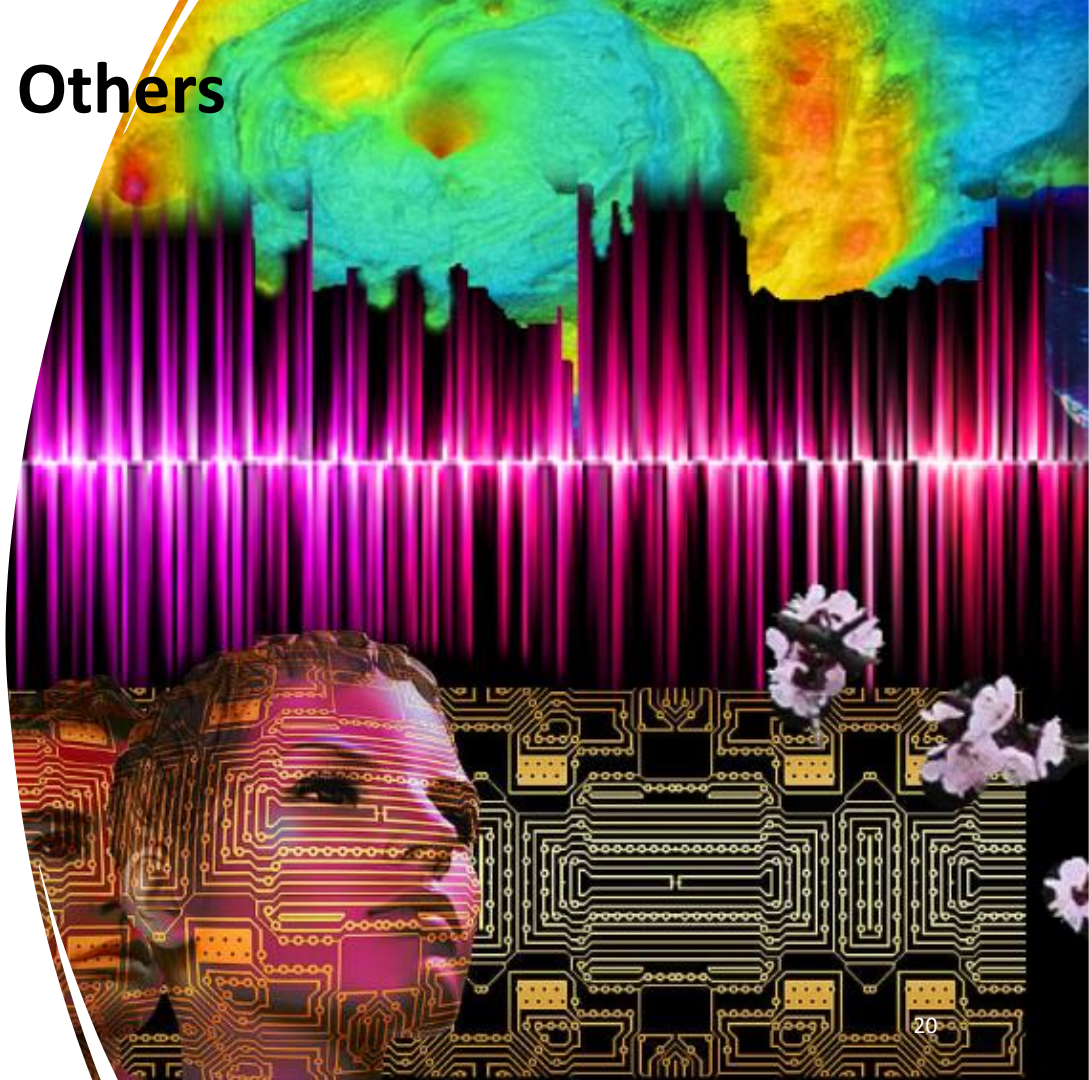




5.6 Reports, Courses and Others

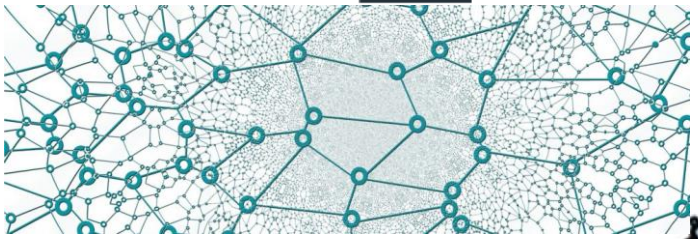
[8] **AI in Biology**, https://aibiology.github.io

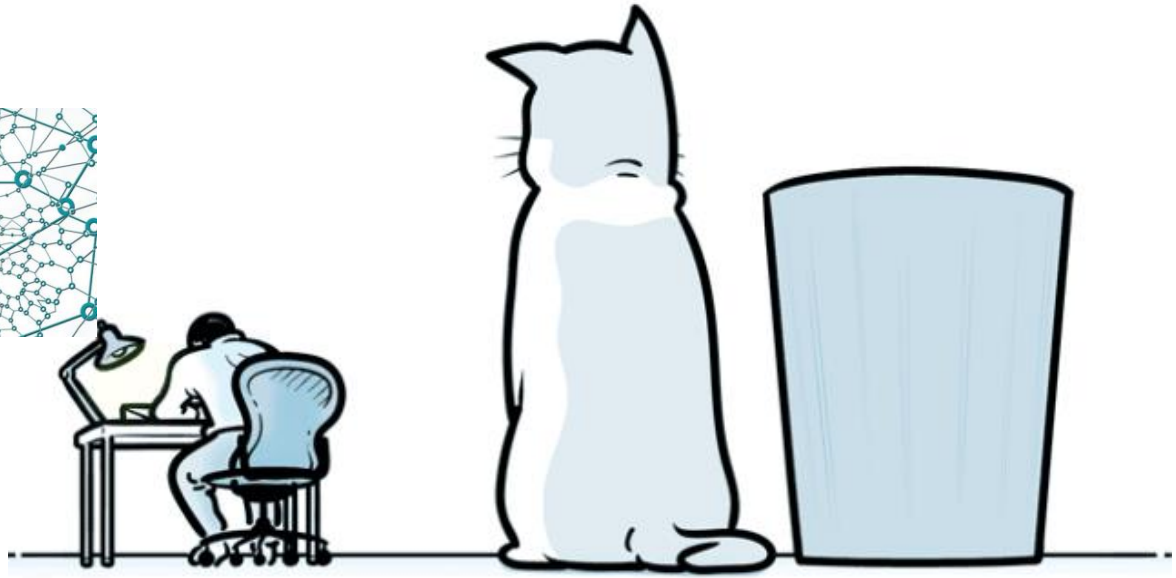
[9] CompSci 271: Introduction to Artificial Intelligence, Fall 2018 , https://ics.uci.edu/~kkask/Fall-2018%20CS271/index.html



Thanks and Questions

https://github.com/LeoYiChen/Introduction2AI-202010





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Thanks and Questions