Deep Learning – Concepts and PyTorch Development

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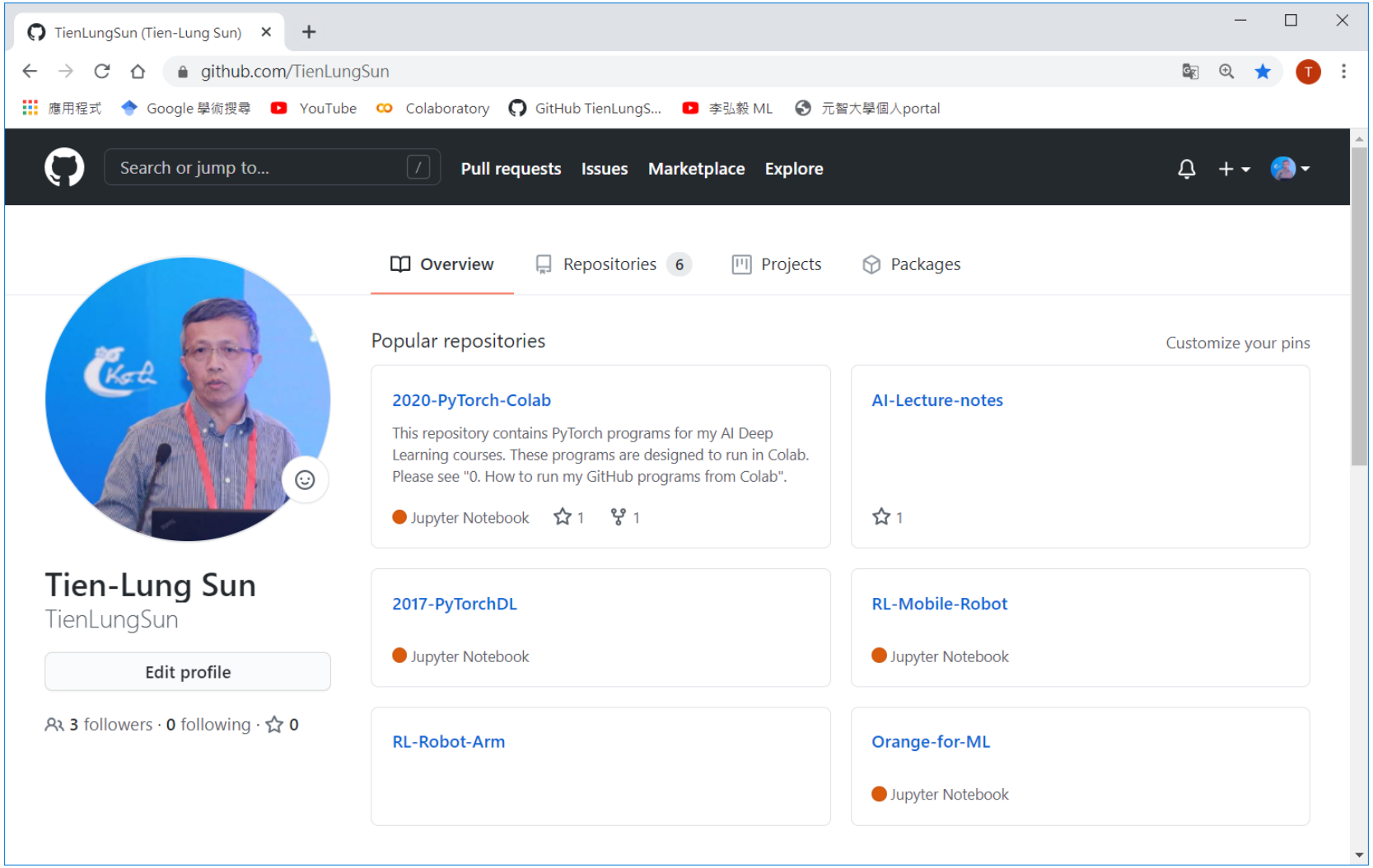
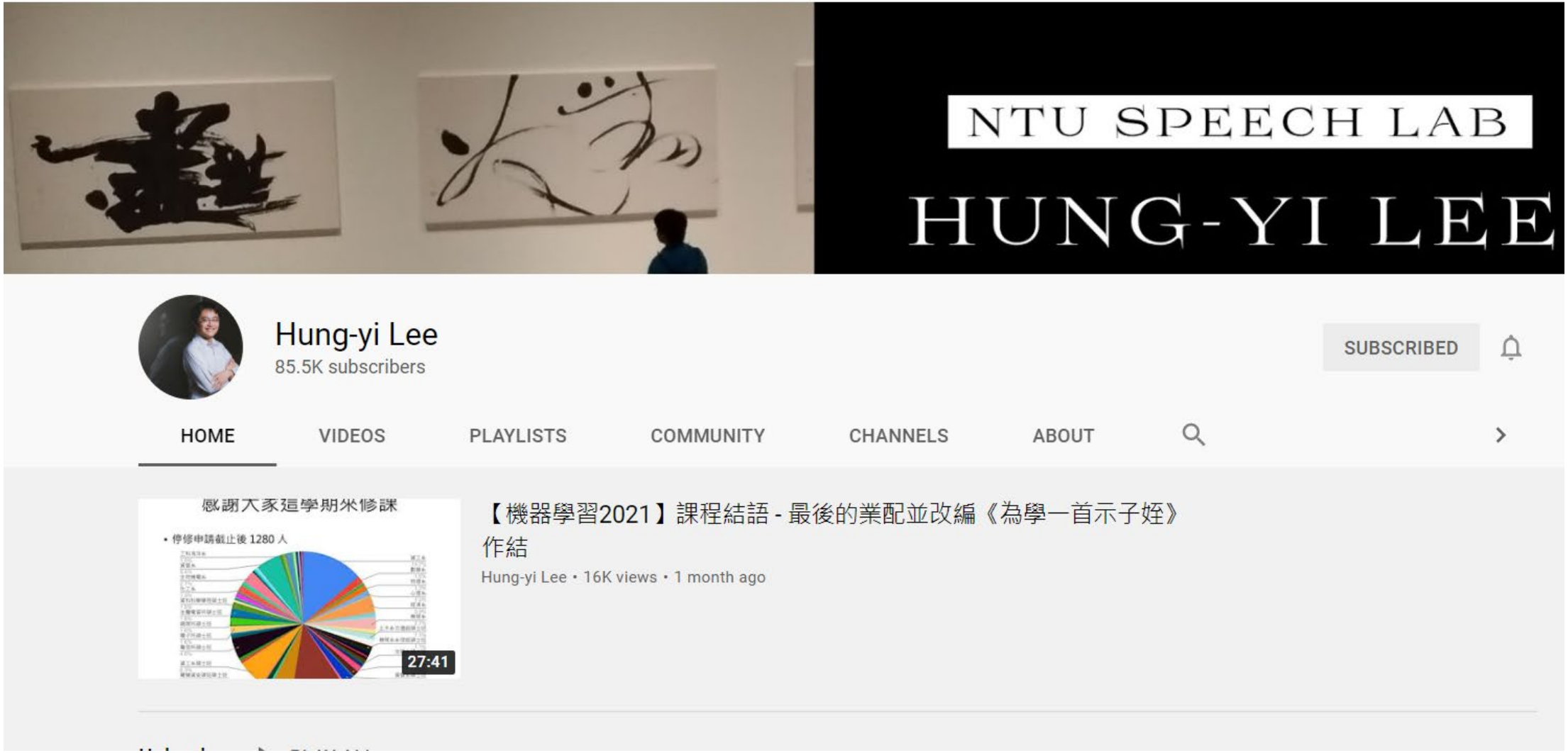
My GitHub



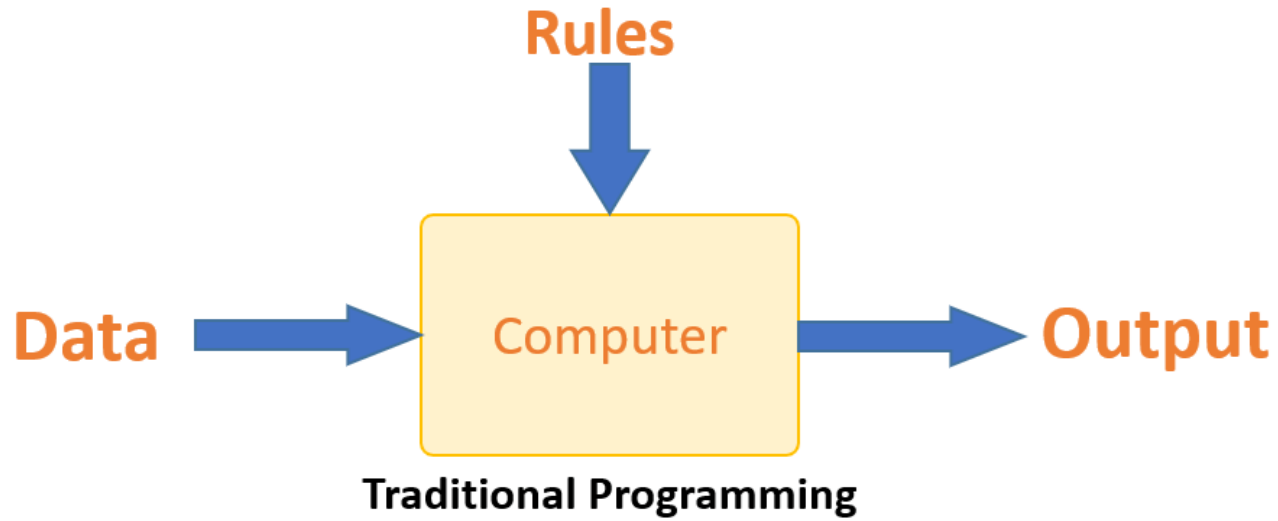
http://github.com/TienLungSun

Acknowledgement



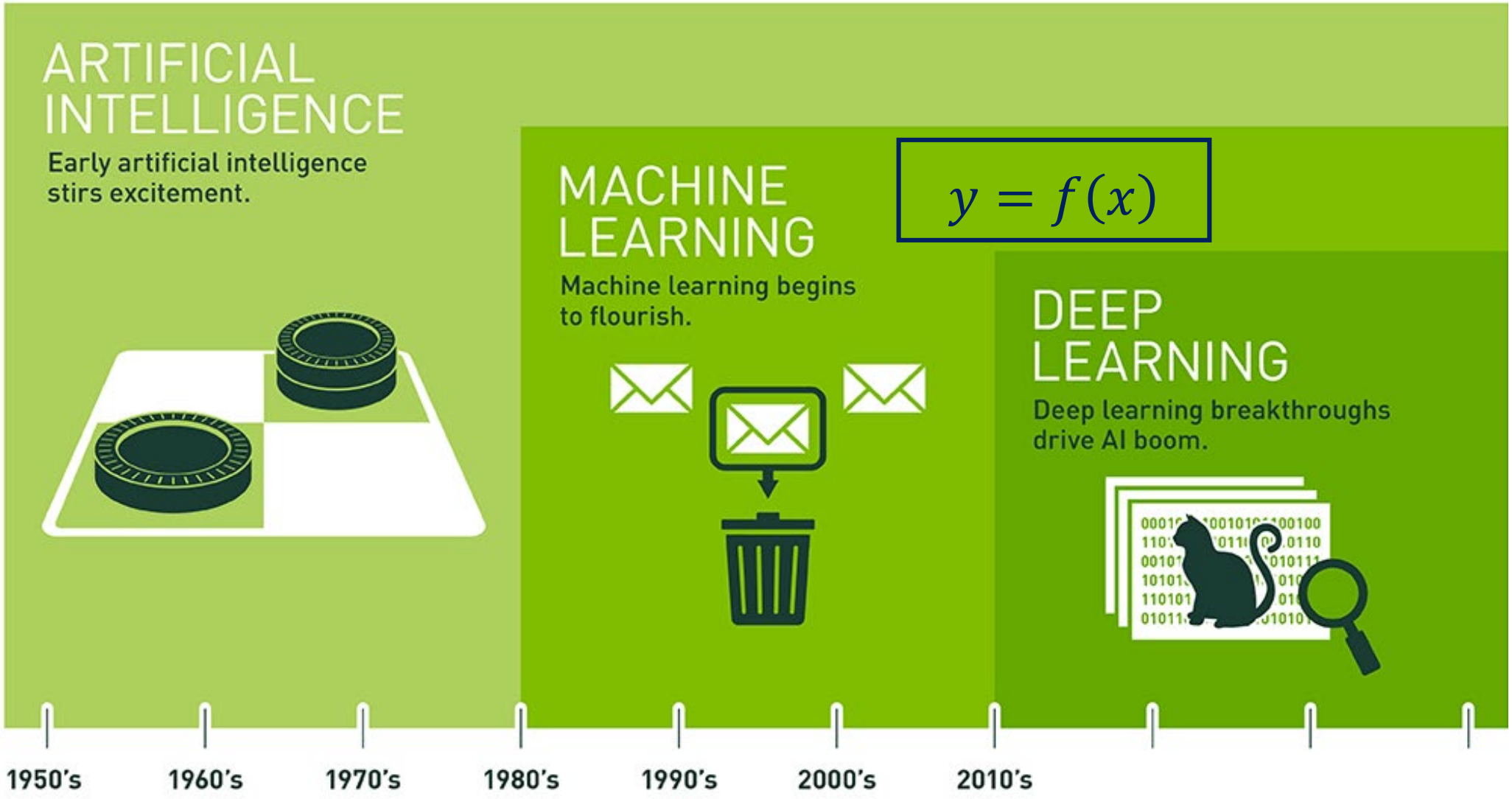
https://www.youtube.com/c/HungyiLeeNTU

Machine learning vs programming



https://www.guru99.com/machine-learning-tutorial.html

Machine learning vs AI



https://blogs.nvidia.com/blog/2016/07/29/whats-difference-artificial-intelligence-machine-learning-deep-learning-ai/

Pros and cons of machine learning

- As machine learns $y = f(x)$ from data by itself rather than human programmed, it is more flexible in handling new, un-seen cases.
- As machine learns the mapping $y = f(x)$ from data, it is restricted and biased to the data it sees.

AI prediction model is as good as its training data

1. 電腦在學習的時候，是依賴「彙整數據資料」來判斷，並沒有真正思考，如果資料來源太狹隘、不夠多元，資料寬廣度不足，電腦判斷就會出現偏差，「你跟電腦講清楚 input（輸入）、output（輸出），提供足夠的數據資料，它可以對應、學得很好，但還有很多面向 AI 做不到。」
2. AI 另一項挑戰是，它無法清楚分辨「不曾出現」與「不能出現」（無法出現）之間的區別，只是從資料統計出要學的東西，無法像人類一樣進行邏輯思辨。

https://www.managertoday.com.tw/articles/view/62902

UCLA CS 助理教授張凱崴 (台大資工， UIUC PhD， 2021 史隆研究獎)

Human-in-the-loop

- 數據收集一定有數據無法cover的地方，而且在產線上，通常相同的錯誤不會一直出現，這是在AI model應用在工業最大的弱點。
- 一般會同時使用2~3 個機器學習模型去預測，當結果都是一樣的，我才相信，如果AI模型預測結果不一致，演算法就不會預測，會交給現場工程師去判斷，所以在工業界都說是提供人機協同的介面。

(Ref: Dicky)

Mechanisms of machine learning

1. Define a function to be learned: $y = f(x)$
2. Define a loss function $\mathcal{L}$ to describe the error between $y = f(x)$ and $\hat{y}$
3. Find the optimal parameters of f that minimize $\mathcal{L}$

Deep Learning

Geoffrey Hinton spent 30 years hammering away at an idea most other scientists dismissed as nonsense. Then, one day in 2012, he was proven right. Canada's most influential thinker in the field of artificial intelligence is far too classy to say I told you so

https://torontolife.com/tech/ai-superstars-google-facebook-apple-studied-guy/

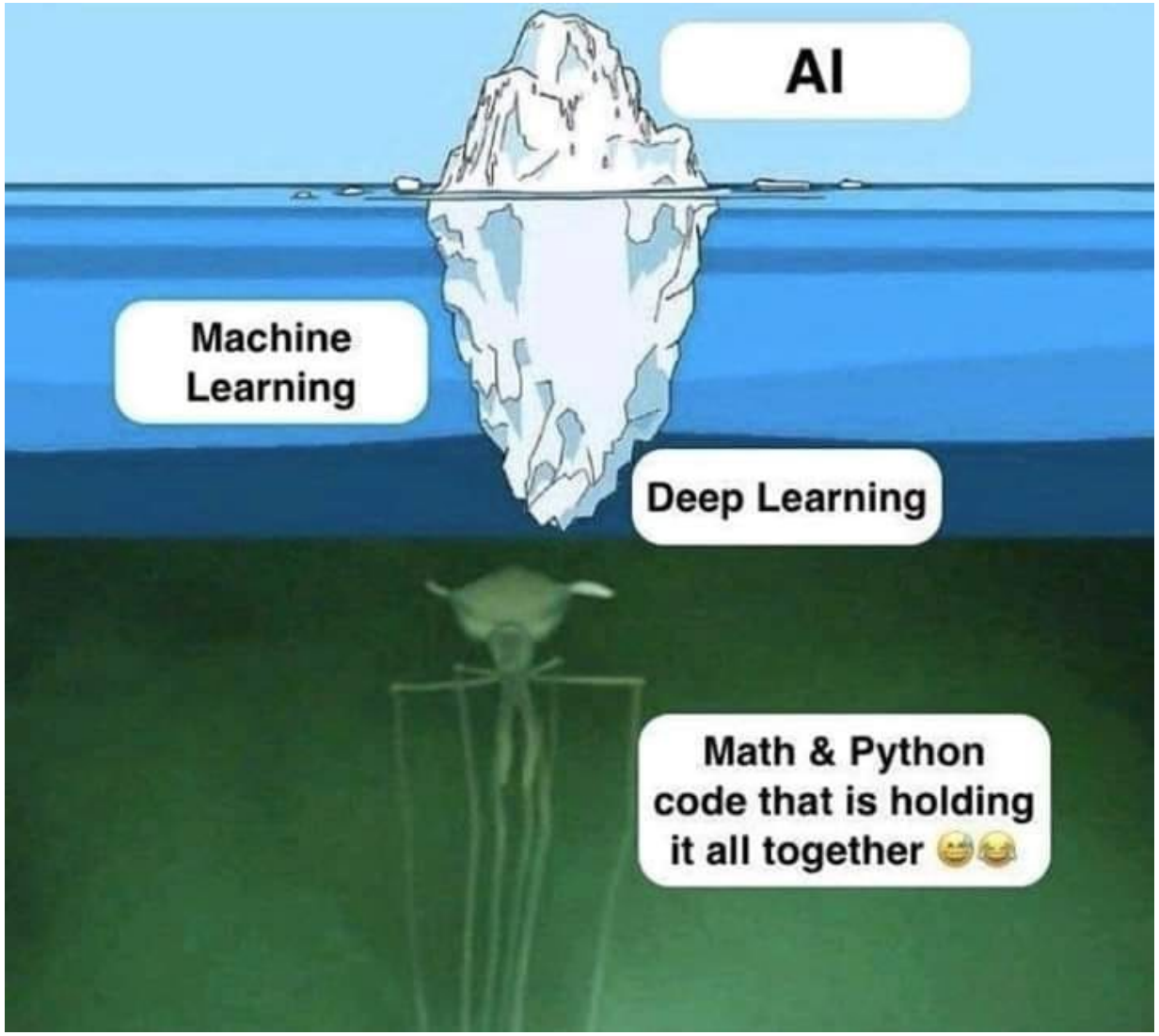
For more than 30 years， Geoffrey Hinton hovered at the edges of artificial intelligence research，an outsider clinging to a simple proposition: that computers could think like humans do—using intuition rather than rules.

Geoffrey Hinton 多年來堅持着一個簡單的觀點：電腦可以像人類一樣思考-用直覺而不是規則。
Hinton 一直好奇的是，電腦能不能像人類大腦一樣的工作：信息通過一個巨大的，由神經元圖譜連接起來的細胞網絡傳播，在多達十億條的路徑上發射、連接和傳輸。

Strategies of machine learning

	Supervised Learning	Self-supervised Learning	Reinforcement Learning
	Recognition		Act
1. Function to be learned	MLP, CNN families	AE/VAE, GAN	Actor
	$y = f(x)$	$\hat{x} = f(x)$	$a = f(s)$
2. Loss function $\mathcal{L}(f)$	MSE, CE	MSE, CE, KLD, JSD	MSE, KLD
3. Minimize $\mathcal{L}(f)$	Gradient decent, Maximum Likelihood		

Math and coding

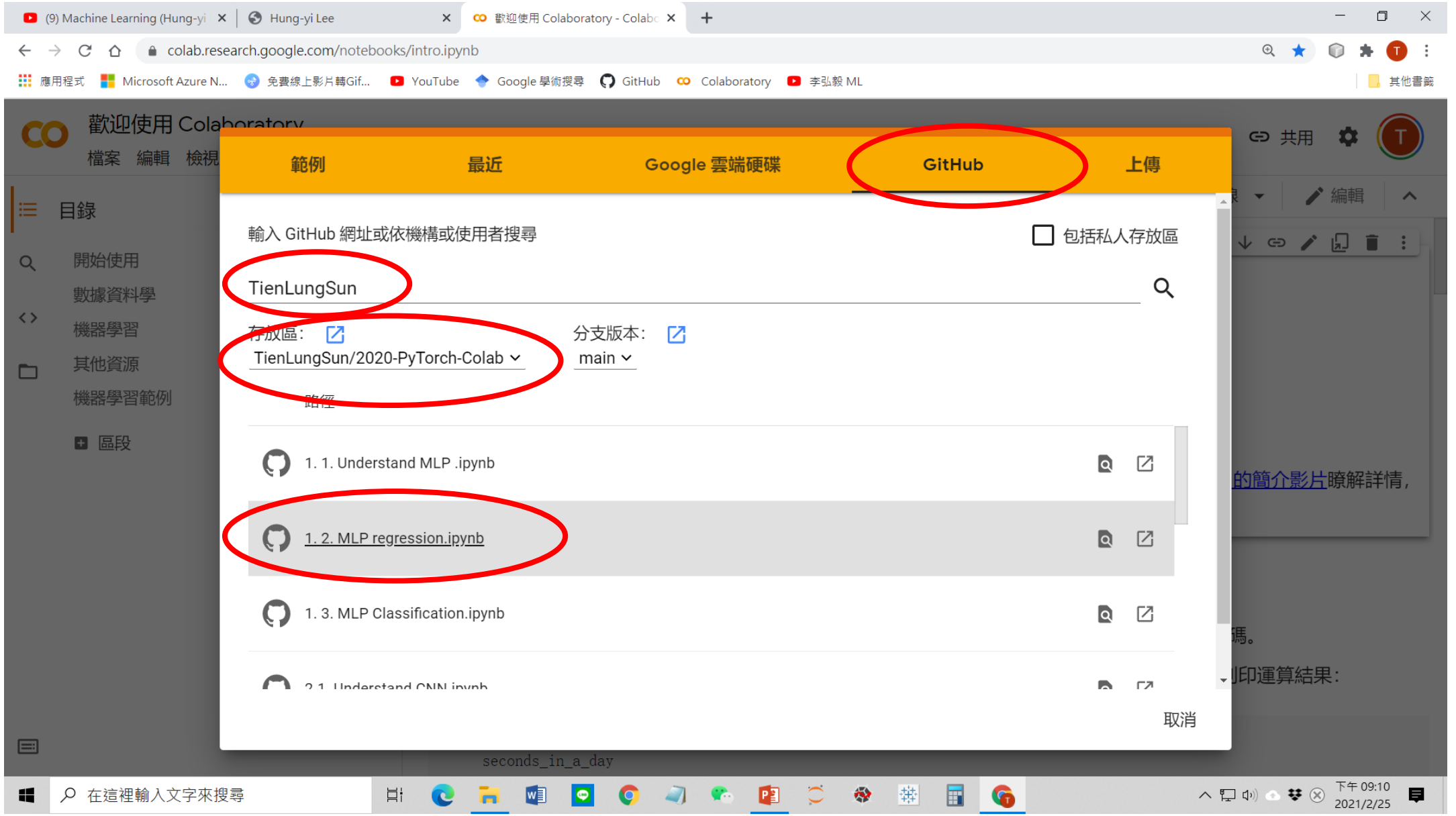


- Probability and statistics
- Non-linear optimization
- Linear algebra

https://www.facebook.com/257118421832544/photos/a.320314752179577/540486140162436/

Python

Run my PyTorch code in GitHub from Colab



Reference

The Principles of Deep Learning Theory

An Effective Theory Approach to Understanding Neural Networks

Daniel A. Roberts and Sho Yaida

based on research in collaboration with

Boris Hanin

drob@mit.edu, shoyaida@fb.com

PDLT.pdf (deeplearningtheory.com)

Reference

A PyTorch implementation for bag of useful tricks

- Stochastic Depth arXiv
- Warm up arXiv
- Label Smoothing arXiv
- No Bias Weight Decay arXiv
- Teacher-Student Knowledge Distillation arXiv
- Mixup arXiv
- Group Normalization arXiv
- Weight Standardization arXiv

GitHub - jeff52415/Tips-for-improving-your-neural-network-pytorch: A PyTorch implementation for bag of useful tricks, Provide training example for Cifar10

Reference

卷積神經網路優化Part1：Bag of Tricks for Improving your Neural Networks Training

Cinnamon AI Taiwan 15 hours ago · 17 min read

> *隨著深度學習不斷的演進，越來越多的架構騰空出世並在學術界的資料集上達到State Of The Art，然而大多文獻中沒提到的是，部分精度、性能上的提升並不全然來自架構的更新，而是訓練上的技巧，本文會介紹幾種實用的操作，並附上PyTorch實作代碼。*

[卷積神經網路優化Part1：Bag of Tricks for Improving your Neural Networks Training | by Cinnamon AI Taiwan | Jun, 2021 | Medium]