Course Project

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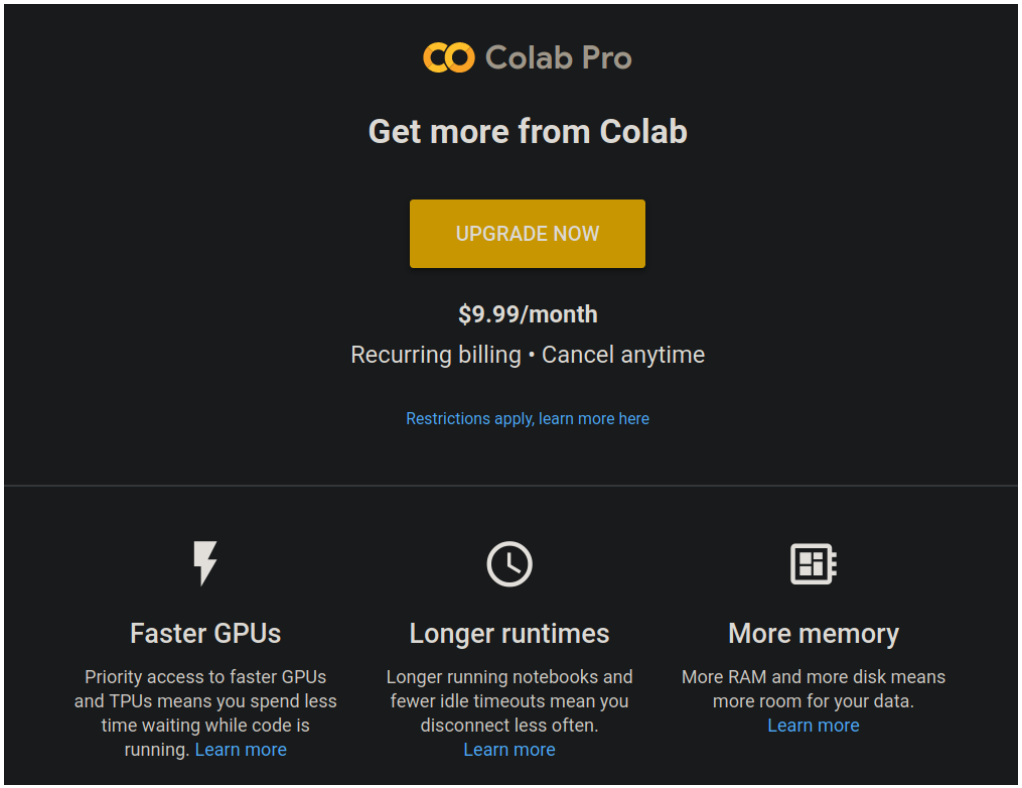
Outline

Announcements

- HW1 is out. Due: Oct 15th
- Colab Pro https://colab.research.google.com/signup



Outline

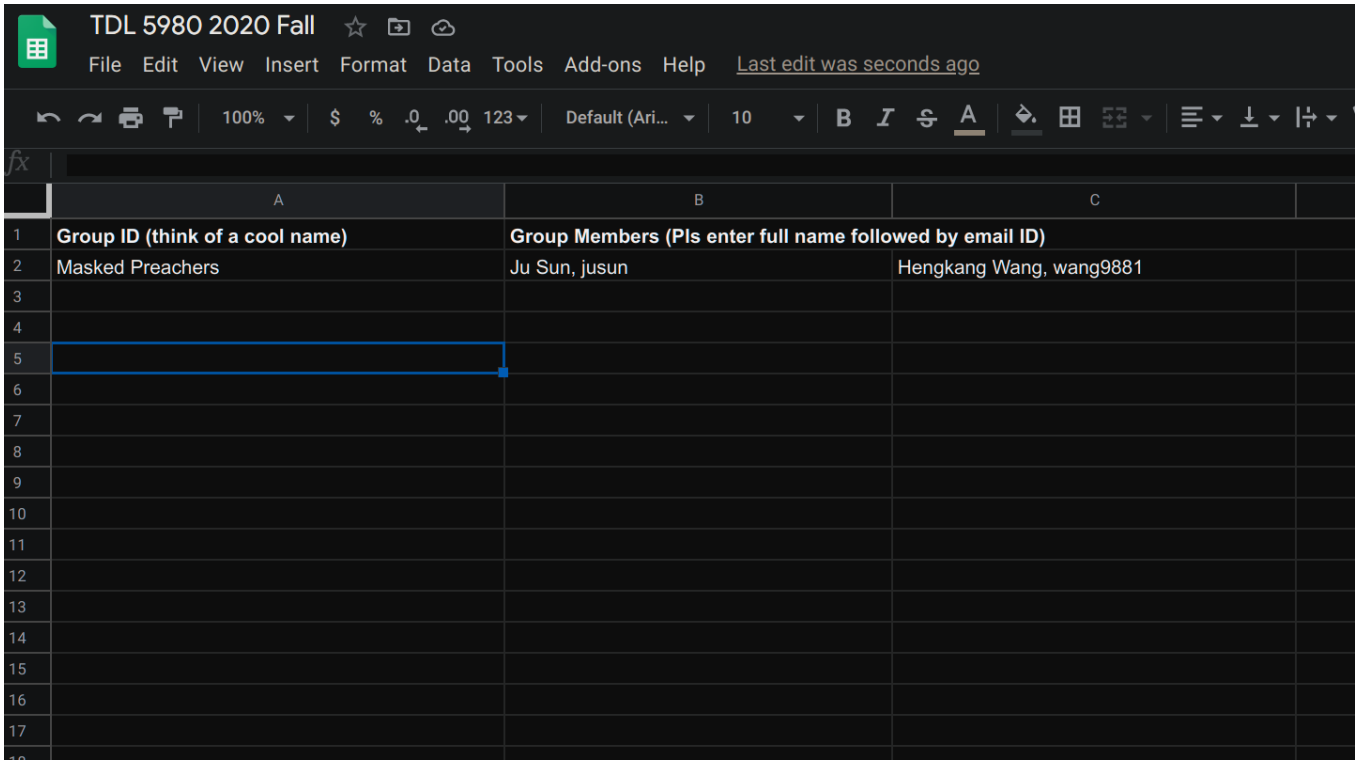
Timeline & LaTeX template

- Proposal (5%, 1 page): Oct 23
- Progress presentation (5%, 5 mins): Nov 23
- Progress report (10%, 3–4 pages): Nov 27
- Final report (20%, 7–8 pages): Dec 22
- Publishable results $\Longrightarrow$ A!

Template for all writeups: NeurIPS 2020 LaTeX style

https://nips.cc/Conferences/2020/PaperInformation/StyleFiles

Groups



- 5980: 2–3 students / 8980: 2 students
- All submissions as a group (in Canvas as group assignment); the group gets the same score

Proposal

- What problem?
- Why interesting?
- Previous work
- Your goal
- Plan and milestones

8980 Survey Paper

- Individual work (15%)
- Template for all writeups: NeurIPS 2020 LaTeX style https://nips.cc/Conferences/2020/PaperInformation/StyleFiles
- Due: Dec 05
- Talk to me about choice of topic

Outline

Overview

Roughly by ascending level of difficulty

- Literature survey/review
- Novel applications
- Novel methods
- Novel theories

Excerpt from a research project is fine, but you should describe your own contributions

Literature survey/review

A coherent account of recent papers in a focused topic

- Description and comparison of main ideas, or
- Implementation and comparison of performance, or
- Both of the above

should complement the topics we cover in the course

https://paperswithcode.com/rc2020

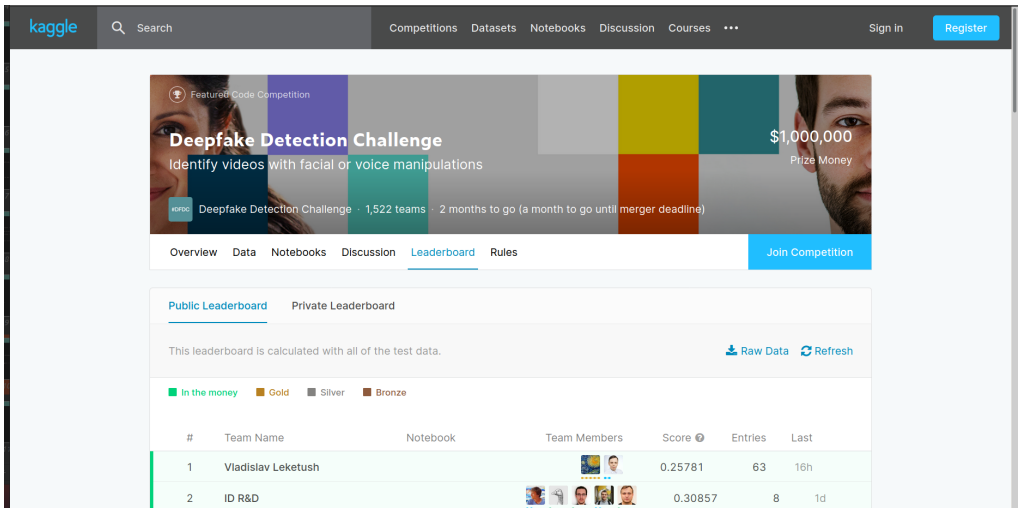
Random topics

- DL for noneuclidean data (e.g., graph NN, manifold NN)
- transformer models for sequential data
- generative models (e.g., GAN, VAE, normalization flow)
- 2nd order methods for deep learning
- differential programming
- universal approximation theorems
- DL for 3D reconstruction
- DL for video understanding and analysis
- DL for solving PDEs
- RL for games
- RL for robotics
- DL for medical imaging
- DL for (astro)physics
- DL for chemistry
- adversarial attacks; robustness of DL
- privacy, fairness in DL
- visualization for DNN
- network quantization and compression
- hardware/software platforms for DL
- automated ML; architecture search
- optimization/generalization theory of DL

Novel applications

Apply DL to **new** application problems

- A good place to start: Kaggle https://www.kaggle.com/



- Think about data availability

  Google dataset search
  https://datasetsearch.research.google.com/

- Think about GPUs

Where to find inspirations

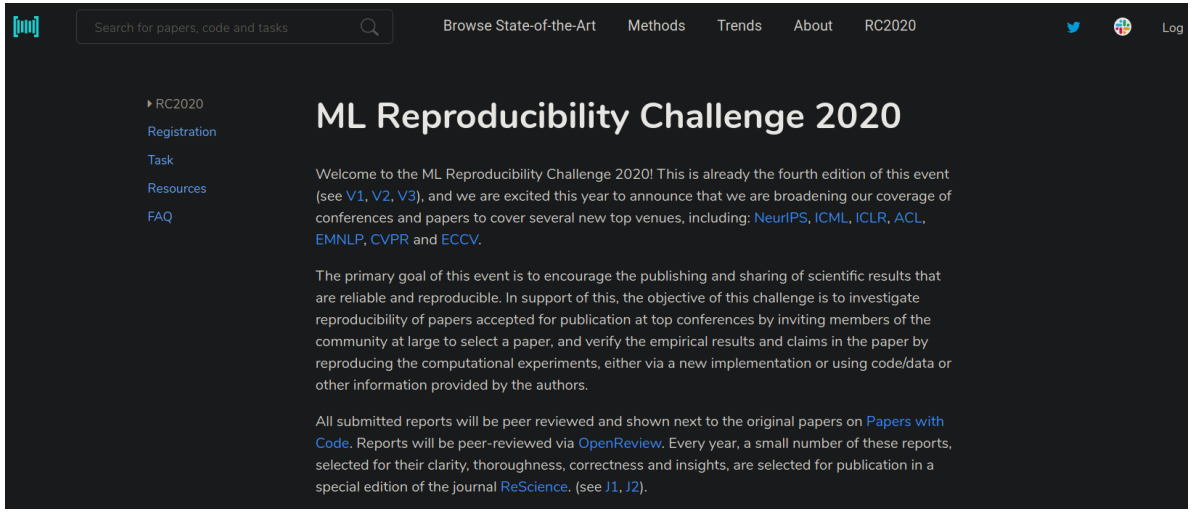
- arXiv machine learning
  https://arxiv.org/list/cs.LG/recent
- Recent conference papers
  - ML: NeurIPS, ICML, ICLR, etc
  - CV: ICCV, ECCV, CVPR, etc
  - NLP: ACL, EMNLP, etc
  - Robotics: ICRA, etc
  - Graphics: SIGGRAPH, etc
- Talk to researchers!

Novel methods

Create new **NN models or training algorithms** to improve the state-of-the-art

Where to start:

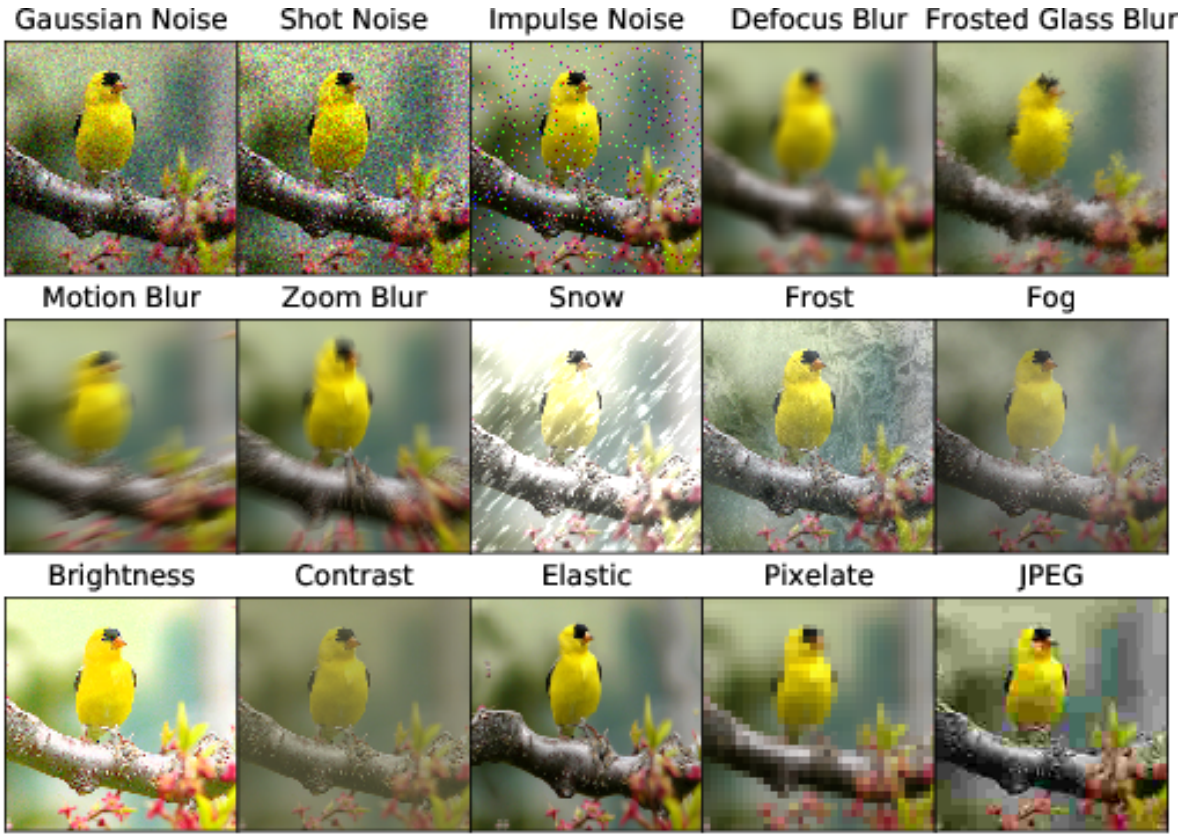
- Kaggle (again)!
- arXiv machine learning and recent conference papers
- MLRC



https://paperswithcode.com/rc2020

Novel methods

Equally interesting to fool/fail the state-of-the-art, i.e., exploring robustness of DL



Credit: ImageNet-C

Novel theories

Nothing is more practical than a good theory. – V. Vapnik

- universal approximation theorems
- nonconvex optimization
- generalization

Where to start:

- Analyses of Deep Learning (Stanford, fall 2019)
  https://stats385.github.io/
- Theories of Deep Learning (Stanford, fall 2017)
  https://stats385.github.io/stats385_2017.github.io/
- Toward theoretical understanding of deep learning (ICML 2018 Tutorial)
  https://unsupervised.cs.princeton.edu/deeplearningtutorial.html

Questions?