Seminars

proposed topics are grouped in four areas:

(choose one topic from below lists)

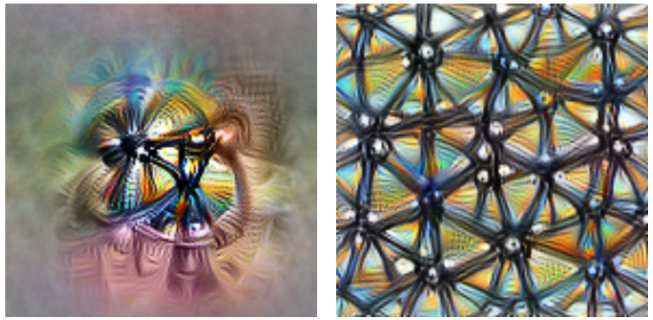
1. understanding deep neural networks
2. overview on other ML techniques
3. natural language processing
4. advanced computer vision

time limit: 15 minutes + 5-minute discussion

Seminars: understanding deep neural networks

1. **Techniques that allow understand more on how and why deep architectures work**

- https://distill.pub/2020/circuits/early-vision/
- https://ai.googleblog.com/2015/06/inceptionism-going-deeper-into-neural.html
- https://distill.pub/2017/feature-visualization/
- D. Erhan, Y. Bengio, A. Courville, P. Vincent. , Visualizing higher-layer features of a deep network (2009).
- http://arxiv.org/pdf/1506.02753.pdf
- https://arxiv.org/pdf/1312.6034v2.pdf
- https://github.com/tensorflow/lucid

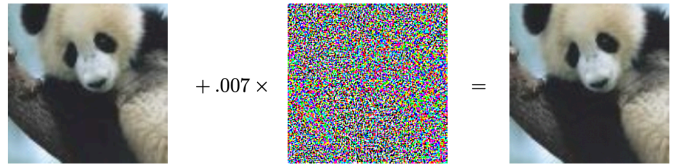


Feature visualization answers questions about what a network—or parts of a network—are looking for by generating examples.

2. **Fooling deep neural networks:** deep learning models are highly sensitive to carefully prepared adversarial attacks

How to generate adversarial examples? Can we use them to improve network stability?

- Szegedy, Christian, et al. "Intriguing properties of neural networks" *arXiv:1312.6199* (2013).
- Goodfellow, Ian J., Jonathon Shlens, and Christian Szegedy. "Explaining and harnessing adversarial examples" *arXiv:1412.6572* (2014).
- Papernot, Nicolas, et al. "The limitations of deep learning in adversarial settings." *2016 IEEE European symposium on security and privacy (EuroS&P)*. IEEE (2016).
- Su, Jiawei, Danilo V. Vargas, and Kouichi Sakurai. "One pixel attack for fooling deep neural networks." *IEEE Transactions on Evolutionary Computation* 23.5 828 (2019).



3. **Defense strategies against adversarial attacks**

Overview on various techniques for defending against adversarial examples for attacking deep neural networks.

- Szegedy, Christian, et al. "Intriguing properties of neural networks" *arXiv:1312.6199* (2013).
- Xie, Cihang, et al. "Mitigating adversarial effects through randomization." *arXiv:1711.01991* (2017).
- Das, Nilaksh, et al. "Keeping the bad guys out: Protecting and vaccinating deep learning with jpeg compression." *arXiv:1705.02900* (2017).
- Xie, Cihang, et al. "Feature denoising for improving adversarial robustness." *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition* (2019).
- Goodfellow, Ian J., Jonathon Shlens, and Christian Szegedy. "Explaining and harnessing adversarial examples" *arXiv:1412.6572* (2014).

Seminars: overview on other ML techniques

1. **Reinforcement Learning**

Basics and applications

- https://arxiv.org/pdf/cs/9605103.pdf
- https://mpatacchiola.github.io/blog/2016/12/09/dissecting-reinforcement-learning.html
- https://deepsense.ai/what-is-reinforcement-learning-the-complete-guide/

2. **Hidden Markov model**

Definition and example applications

- https://jonathan-hui.medium.com/machine-learning-hidden-markov-model-hmm-31660d217a61
- http://www.cs.sjsu.edu/~stamp/RUA/HMM.pdf

3. **Recommender systems**

Idea, applications and the Netflix Price

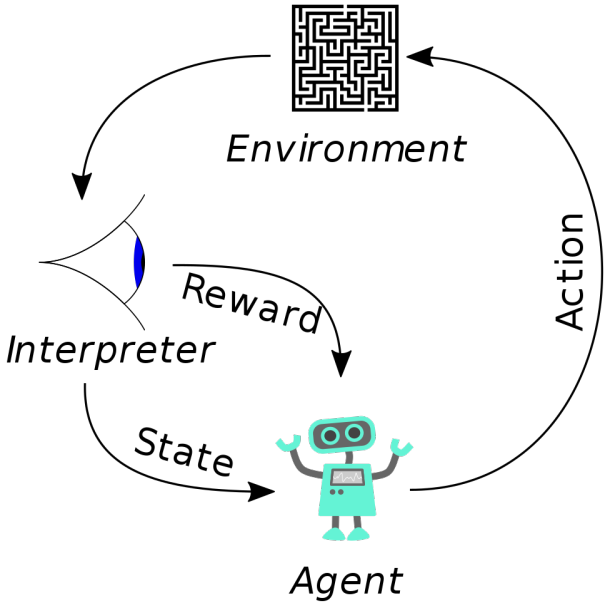
- https://arxiv.org/pdf/1203.4487.pdf
- https://towardsdatascience.com/introduction-to-recommender-systems-6c66cf15ada

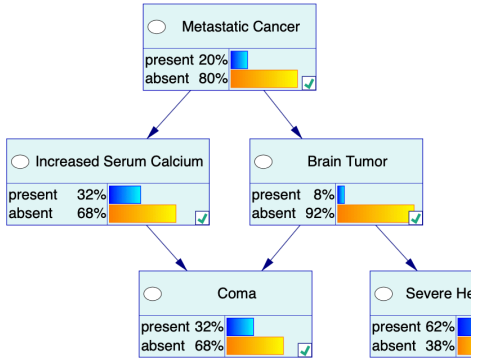
4. **Bayesian networks**

- https://repo.bayesfusion.com/bayesbox.html
- http://www.eng.tau.ac.il/~bengal/BN.pdf
- http://www.niedermayer.ca/node/35

5. **Evolutionary optimization methods**

- differential evolution
- particle swarm optimization





Seminars: natural language processing, NLP

1. **Optical character recognition (OCR)**

- problem definition
- classical or neural network approach: an overview
- presenting one particular engine, e.g. state-of-the-art *Tesseract* (what deep learning model is used inside?)
- https://tesseract-ocr.github.io/tessdoc/

2. **Automatic speech recognition (ASR)**

- problem definition
- possible applications
- databases (e.g. *Librispeech*)
- an overview on single specific algorithm, e.g. *ContextNet* or *Deep Speech*
- https://arxiv.org/pdf/2005.03191.pdf
- https://arxiv.org/pdf/1512.02595.pdf

3. **Machine Translation**

- problem definition, example methods

4. **Question Answering**

- problem definition, example methods

5. **BERT** natural language model

- overview, importance

Seminars: computer vision

1. **Point Feature Matching**

- problem definition
- classical and deep learning approaches
- *SuperGlue* algorithm: https://arxiv.org/abs/1911.11763

2. **Pose estimation**

- problem definition and deep-learning solution, e.g.:
- https://arxiv.org/pdf/1803.08225.pdf

3. **Super-Resolution**

- idea, applications, algorithms
- https://arxiv.org/abs/1809.00219

4. **Any other problem with machine learning solution**