

Advanced Topics in Continual / Organic Machine Learning

Interactive Systems Lab (ISL)
Institute for Anthropomatics and Robotics (IAR)

Summer 20 Topics

"I'm still learning"
Michelangelo

Comparison of pretrained NLP models

- pretrained on huge datasets (in most cases unsupervised)
- possible to fine-tune to a specific task
- in most NLP tasks: state-of-the-art performance
- similar to OML: learn with few data, because general natural language understanding learned in the pretraining

Papers:

- BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding, Devlin et al., 2018
- RoBERTa: A Robustly Optimized BERT Pretraining Approach, Liu et al., 2019
- Transformer-XL: Attentive Language Models Beyond a Fixed-Length Context, Dai et al., 2019

GANs in Dialog Systems

- GANs have a generator that generates new examples and a discriminator that assess the generated examples
- using GANs for dialog modelling, e.g.
- generate responses by noise samples conditioned on the dialog history and rank generated responses by the discriminator

Papers:

- Multi-turn Dialogue Response Generation in an Adversarial Learning Framework, Olabiyi et al. 2018
- An Adversarial Learning Framework For A Persona-Based Multi-Turn Dialogue Model, Olabiyi et al., 2019
- TextKD-GAN: Text Generation using Knowledge Distillation and Generative Adversarial Networks, Haidar et al., 2019
- Dialogue generation with GAN, Su et al, 2018

Never ending Learning

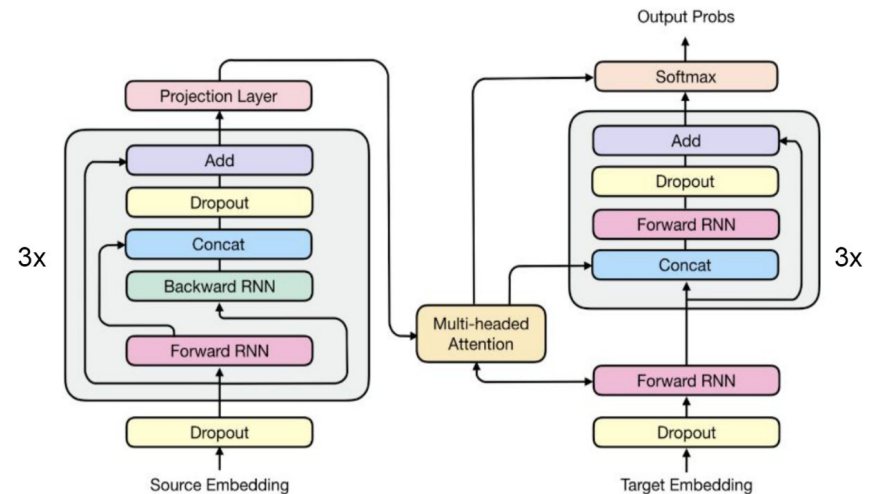
- a computer system that learns over time to read the web
- since January 2010, the computer system called NELL (Never-Ending Language Learner) is learning
- extracts facts from text found in hundreds of millions of web pages (e.g., `playsInstrument(George_Harrison, guitar)`)
- attempts to improve its reading competence

Papers:

- Never-ending learning, Mitchell et al., 2018
- Learning without forgetting, Li et al, 2017

End-to-end spelling correction

- Automatic speech recognition (ASR)
- Language model on text-only data
- Spelling correction (SC) model
- Incorporating errors made by ASR model



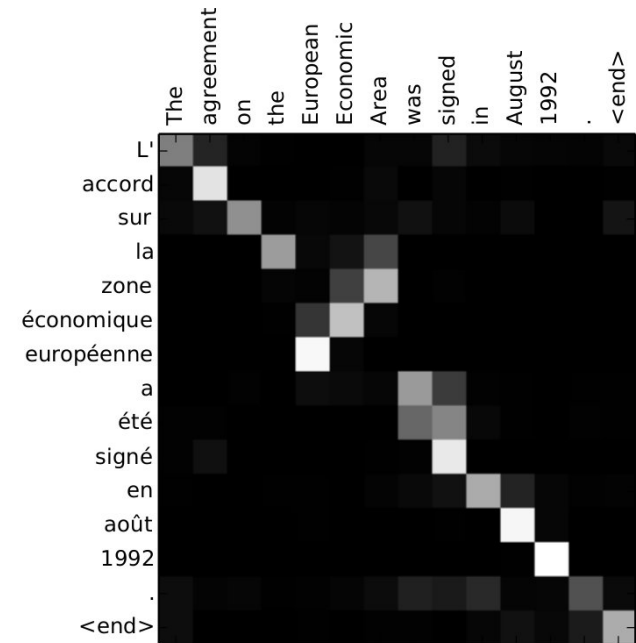
Source: »A spelling correction model for end-to-end speech recognition«, Guo et al., 2019

Papers:

- **A spelling correction model for end-to-end speech recognition, Guo et al., 2019**
- Listen, attend and spell: A neural network for large vocabulary conversational speech recognition, Chan et al., 2016

Interpretability of attention in NLP

- Natural language processing (NLP)
- Bahdanau et. als' attention widely used in NLP
- Feature importance correlation
- Tasks: binary text classification, question answering, natural language inference



Source: »Neural Machine Translation by Jointly Learning to Align and Translate«, Bahdanau et al., 2014

Papers:

- **Attention is not Explanation, Jain and Wallace, 2019**
- Neural Machine Translation by Jointly Learning to Align and Translate, Bahdanau et. al, 2014

Incremental Learning with Adversarial Networks

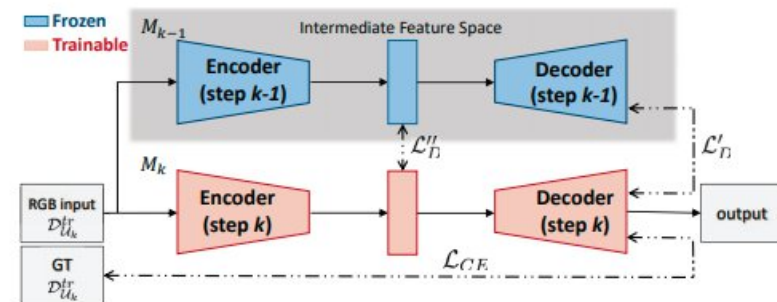
- GAN-based approach for incremental learning
- Propose a new loss function
- Eliminate the unbalanced data distribution between old classes and new classes
- Generate historical data with GAN

Papers:

- Incremental Classifier Learning with Generative Adversarial Networks, Wu et al., 2018
- Incremental Learning Using Conditional Adversarial Networks, Xiang et al., 2019

Semantic Segmentation

- Incremental learning for semantic segmentation
- Distill the knowledge of the previous model
- Learn to segment new classes



Papers:

- Incremental Learning Techniques for Semantic Segmentation, Michieli et al., 2019
- Incremental Learning for Semantic Segmentation of Large-Scale Remote Sensing Data, Tasar et al., 2019

Class Incremental Learning

- Avoid from biased model towards old classes and new classes
- Novel objective function
- Solve the data imbalance problem
- Solve the increasing number of visually similar classes

Papers:

- Class-incremental Learning via Deep Model Consolidation, Zhang et al., 2020
- Large Scale Incremental Learning, Wu et al., 2019

Online Face Recognition

- Online unsupervised face identity learning
- Memory based learning mechanism



Papers:

- Memory Based Online Learning of Deep Representations from Video Streams, Pernici et al., 2018
- Incremental Learning of People Identities, , Bartoli et al., 2019

Knowledge utilization

- Use external sources like the Internet to give better answers (humans do sometimes the same)
 - Explain how to incorporate external sources in neural models
- A Knowledge-Grounded Neural Conversation Model (Ghazvininejad et al., 2017)
- Extending Neural Generative Conversational Model using External Knowledge Sources (Parthasarathi et al. 2018)

Self-Supervised Learning

- A machine learning system that uses supervised learning techniques (e.g. NNs) to learn from automatically labelled data
 - No labelled data needed
 - Explain methods/applications
- Deep Clustering for Unsupervised Learning of Visual Features (Caron et al. 2018)