ITCS 4111/5111: Intro to Natural Language Processing

Final Project

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Models to be covered

- **Hidden Markov Models (HMM) & Conditional Random Fields (CRF):**
  - Chapter 8 in J&M.
  - Sequence labeling:
    - Named Entity Recognition, POS tagging.

- **Recurrent Neural Networks (RNNs), LSTMs:**
  - Sections 9.1 to 9.6 in J&M.
  - Sequence labeling and Classification:
    - Text Classification, e.g. Sentiment Analysis.
    - Relation extraction.

- **Contextualized Word Embeddings** and **Pre-training for NLP:**
  - **Transformer**, GPT, and BERT.
    - Sections 9.7 to 9.9 in J&M.
    - Many NLP tasks.
Implementations, publicly available

- **Conditional Random Fields (CRFs):**
  - [https://github.com/scrapinghub/python-crf-suite](https://github.com/scrapinghub/python-crf-suite)
  - [https://github.com/chokkan/crf-suite](https://github.com/chokkan/crf-suite)

- **RNNs, LSTMs:**
  - [https://pytorch.org/](https://pytorch.org/)
    - [https://pytorch.org/tutorials/beginner/nlp/sequence_models_tutorial.html](https://pytorch.org/tutorials/beginner/nlp/sequence_models_tutorial.html)

- **Transformer-based models:**
  - [https://nlp.seas.harvard.edu/2018/04/03/attention.html](https://nlp.seas.harvard.edu/2018/04/03/attention.html)
  - [https://pytorch.org/tutorials/beginner/nlp/transformer_tutorial.html](https://pytorch.org/tutorials/beginner/nlp/transformer_tutorial.html)
  - [https://huggingface.co/models](https://huggingface.co/models)
    - **BERT:** [https://huggingface.co/bert-base-uncased](https://huggingface.co/bert-base-uncased)
    - **GPT2:** [https://huggingface.co/gpt2](https://huggingface.co/gpt2)
    - **T5:** [https://huggingface.co/t5-small](https://huggingface.co/t5-small)
NLP Applications

• **Text classification:**
  – Sentiment analysis.

• **Information Extraction:**
  – Named Entitity Recognition, Relation Extraction, Named Entity Linking, Coreference Resolution.
  – Chapter 17 in J&M, chapter 17 in Eisenstein.

• **Question Answering:**
  – Chapter 23 in J&M.

• **Text generation:**
  – Summarization (extractive vs. abstractive).
  – Dialogue (chatbots vs. task-oriented).
  – Chapter 19 in Eisenstein, chapter 24 in J&M.
My NLP Applications & Models

• 2022: Conversational AI, automated TA for coding classes, semantic parsing of mathematics into code, humor generation, …

• 2021: Style transfer, e.g. changing the narrative perspective.

• 2019: Question answering on medical data, using semantic parsing.

• 2019: Diagnosis of speech disorders, using sequence models.

• 2019: Caption generation for figures.


• 2016: Tone classification in Mandarin Chinese.
2016: Information retrieval in software engineering.
2015: Mapping bug reports to source code files.
2013: Sense disambiguation and sense clustering in Wikipedia.
2012: Coreference resolution using adaptive clustering.
2012: Identifying interlingual links in Wikipedia.
2011: Grading short answer questions on student exams.
2010: Question focus identification.
2007: Biomedical relation extraction using Multiple Instance Learning.
My NLP Applications & Models

- 2007: Relation extraction from the web using minimal supervision.
- 2006: Named entity linking using Wikipedia.
- 2005: Relation extraction using subsequence and dependency kernels.
- 2003: Sentiment analysis.
- 2003: Associative anaphora resolution.
- 2001: Question answering.
- 2001: Coreference resolution.
Proposal: Your NLP Application or Model

• Submit a one page PDF document detailing your proposal for the final project.
  – What problem you want to address.
  – What dataset(s) you plan to use.
  – A rough plan for how you will pursue the project (e.g., “we propose to download X system, run it, then implement our system on top of their framework and compare the results”).
  – You can also elaborate on ML model / architecture, features, ...
  – What is the novel contribution of your project. For example:
    • A new application (=> new dataset).
    • An experimental comparison of state-of-the-art models on an NLP task.
    • A new NLP model, an application of NLP techniques to extract linguistic insights from data, …

• While you don’t need a full related work section, you should mention a few pieces of prior work and state how your project relates to them.
Proposal: Your NLP Application or Model

• Only submit a proposal if you are confident that:
  – You can make a **novel contribution**.
  – It represents a **substantial amount of work**:
    • Substantially more than a regular homework assignment.
  – You can **finish** it by the final exam date:
    • Code, data, experimental evaluations, and **project report**.

• If the proposal is not convincing, the recommendation will be to take the final exam.

• On the course website, under the Final Project heading:
  – Tips for choosing a project topic.
  – Project report guidelines.