ECE 1786

Creative Applications of Natural Language Processing

Lecture 4 Part 2: Project Structure

Projects are Engineering

- I believe that the way to learn is to **do**!
- Assignments in course provide basics
- In project you navigate the use of NLP-based neural networks and LLMs

- Includes oral/written communication
  - What, why, how, and results
- Also: Gives you something to talk about in job interview
  - and link to in CV or LinkedIn, such as: https://www.eecg.utoronto.ca/~jayar/ece1786.2022/emojimotion.html

Project Rules

- Done in Groups of **4** [decision made; ~ 34 groups]
  - This requires 3 sessions each for both proposal presentations and final presentations
- Topic of your own choosing
  - must relate to NLP/LLMs & the material covered in this course
  - must be approved by instructor
- Can be *either* be application of NLP *or* research on NLP
  - If research, make sure you have good discussion with me
- Projects in the class should be different from each other
  - If too similar, won't pass approval-in-principle stage
- Must collect and/or **label** some of your own data/**outputs**
  - data is a core part of the ML field, perhaps hardest
  - Must be careful not to do too much

Project Rules, cont'd

- You should use good software development practices
  - Modular code; good names; comments
  - You must use Source code control – Git
  - Will post a lecture on Source Code control using Git

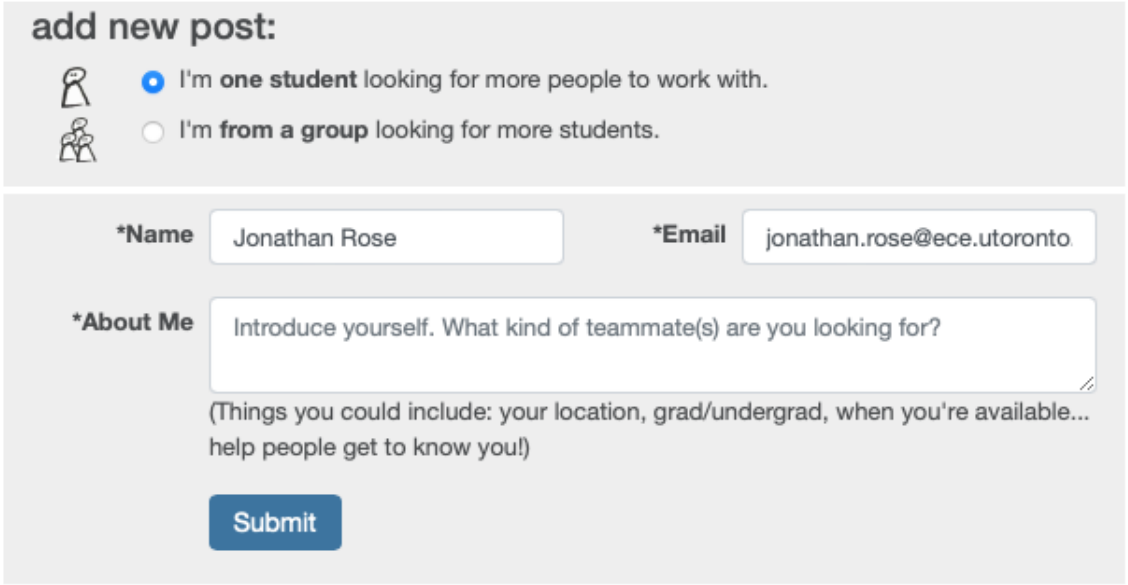
- We will create a Github repository for each team
  - you must use to store, revise and submit your project
  - Required to submit code for progress report and final report, but must be using the whole time

Project Timeline and Deliverables

Date	Item
01-Oct	Project Discussion in Class (Today)
15-Oct	Team Forming Deadline – form to fill out
24-Oct	Approval-in-Principle due - form
04-Nov	Project Proposal Document Due
04-Nov	Project Proposal Slides Due
05-Nov/06-Nov	In-Class Proposal Present + **Extra Class in Evening + Next Eve**
18-Nov	Progress Report Due
04-Dec	Final Presentation Slides Due
03-Dec/04-Dec	Final Presentations + **Extra Class in Evening + Next Eve**
10-Dec	Final Report Due

Step 1: Form Team

- Find people compatible with you
  - on kind of topics interested in
  - on working and communication style
- Should do soon, latest possible deadline October 15
- See ‘find partners’ post, now on Piazza – pinned at top:



Submit Team Info on Form

- This a formal commitment
  - All team members must “sign” (type name) on form.
  - Fill out here: https://forms.office.com/r/A1Rq7SGsnX
- Form requires:
  - Names of all students
  - UofT email address of all members
  - Department of each group member
  - Degree being pursued by each group member (M.Eng, M.A.Sc., Ph.D., MSAC etc.)
  - If you are a part-time or full-time student
- Information needed to organize/track of team projects

Where to find Topics

1. From yourselves! Something you are interested in
2. Suggestions from myself & TAs
3. Look at projects on the internet
   - Previous years in this course: 2022 2023
   - Stanford CS 224n: Natural Language Processing with Deep Learning
   - There will also be a set of suggested projects

- UofT rules on plagiarism apply
  - You can be inspired by ideas on the internet, but you can't use their writing & code, unless you're building something new on top
  - Don't collaborate with another team on topic-finding, as each project must be unique

Scope – How Big Should the Project Be?

- A very difficult question to answer
  - Experience helps, but how to get it?
  - Break idea into pieces, estimate time to do
  - Pay attention to your estimates as you go
- Suggest creating layers of goals
  - Make sure some are achievable
- How much time do you have on project?
  - Two months, minus your other courses & Assignments in this course
- Myself & TAs will be available to discuss
- TA will be assigned to mentor each group

Assistance

- With Proposal & Scope – after class
- Can Email TAs with Questions – see Quercus front page for their emails

- My Weekly Office Hour
  - Mondays 1-2pm
  - Engineering Annex, Room 319 https://map.utoronto.ca/?id=1809#!m/494468
  - Also on Zoom: https://us02web.zoom.us/j/86226422250?pwd=XQ4zraP9GcuWRQlQvoICCi5HVS8SfX.1

The success of LLMs has brought a new kind of complexity to projects like this one.

GPT-4 Has Really Changed What is Easy

- Tasks that used to be quite hard to do, have become very easy to do with large pretrained models like GPT4

Example:

- Previously: classifier to detect anxiety in speech
  - Collect data with anxious and non-anxious people speaking
  - Find a ground-truth label
    - Either a diagnosis (hard) or a self-report survey (easier)
  - Train model with the labels
  - A Ph.D. Thesis

- Now with GPT4:
  - describe what anxious text is to GPT-4,
  - **ask** it to classify the speech as exhibiting it or not

What does this mean for you?

- The task of using the model this way means you might not need to train it.
- However, you will still need to collect related data and labels.
- If you get the data and labels from a dataset, then there will not be too much work at all
  - And will not be sufficient for this course project

Two Classes of Project

- **Class 1: Old Style**
  - You will train a network (or fine-tune a pre-trained network) to do some kind of application
  - This will require some amount of data collection and labelling
  - Could use GPT-2 as base, maybe Llama 3.1/2 or other open source model; will need to deal with the size, not easy
- **Class 2: "LLM" Style**
  - You make full use of the ability of GPT-4 (or other big model) 'to do what is asked'
  - You might not fully understand this yet
  - This is much easier, so you'll need to do something more complex to compensate
  - Also, you'll be face with a more difficult **validation** task
  - need to make a test set with labels + label the outputs

Class 2/LLM Style: Think Differently

- This is an amazing opportunity
- What was once hard, is now maybe much easier
- So we can try to do more difficult things, with multipe *Agents* that are each instances of an LLM:

1. Action GPT: https://actiongpt.github.io
   - Language that guides motion
2. Clue GPT:
   - Solve cross word puzzles using multiple agents
3. QuickPat
   - Patent writing assistant

Action GPT

INTERNATIONAL INSTITUTE OF INFORMATION TECHNOLOGY
HYDERABAD

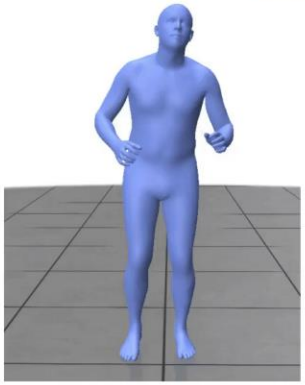
Action-GPT

CVIT


Smoking Cigarette


Stomach Ache

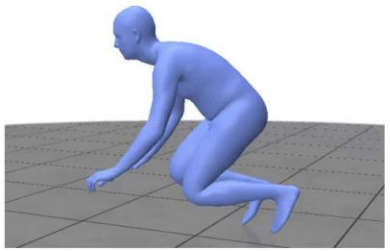

Play a mock violin


Walk with quitely and cunning


Defensive Pose


Referee showing card


Playing DJ


Act like a dog

The Bottom Line

- If you don't train a model yourself, then you'll need to become more inventive in the use of a large language model

- One research-like example:
  - https://arxiv.org/abs/2309.03409

  - Used an LLM in the inner loop of an optimization system to optimize Prompts for a language model

Approval In-Principle/Uniqueness Approval

- Get together with partners to discuss topic ideas.
- Once you've settled on one, write up as follows:

Request for Approval-in-Principle Form

Find the form here: https://forms.office.com/r/gHVaKngvds

1. **What & Why:** 2-3 sentences that describe what the project is and how it is motivated. (Not **How)**

2. **Name:** Give your Project a Name
   - name should convey the essence of project; used for tracking
   - Creates your group identity! Logos also welcomed!

How to Describe Your Topic?

- Key is to say **what** & **why**
  - engineers tend to think about ***how*** too soon, be warned
  - You will need to think about how to make the ***what*** *feasible*, but not in first description for someone else to understand

- Should be the completion of this sentence:

  "The goal of our project is to …"

Picking a Name

- Is fun; it becomes the group's identity
- Should be a word or words that represents the goal/idea/motivation

- Examples from Last Year…

Project Names from ECE 1786 2023

SimpliText	TalkMaster	GenPerfectTrip	LingoEtiquette
ThreatX	MoodSwing	CampusCompanion	FundSeer
ClueGPT	HonestEye	PowerGenX	WiseOldGPT
EmailSense	LSTM	HeartLink	PatientPro
What dialect la	Animyth	NexaHome	PolitiTrend
Whazzat	Political Jokes	LangoBot	Dev GPTeam
QuickPat	FilmEMO	AutoAnnoMI	Sarcastibot
Medley	RedactedGPT	MimicChat	Adversarial LLM Prompts
SalesExpert	PostTellMore		
EcoInsight Detector	Unfair ToS		

Grading

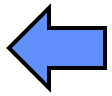
Item	Portion of Course Grade
Proposal (Presentation/Document)	10%
Interim Report	10%
Final Presentation	10%
Peer Reviews	5%
Final Report/Software	25%
Total	60%

Project Proposal Document

Proposal Document

Document **must** have the Following sections:

1. Introduction
   - What and why (i.e. motivation)
2. Background
   - Describe 2-3 related papers you've found
3. Source of Data and Processing
   - Where will you get the data for part of project?
   - Requirement: some collection/labeling the data
     - But can't take up a big chunk of the project either



Proposal Document, cont'd

4. Architecture of the model/Structure of System

Case 1, Old style:

- Rough guesses of type and structure of model
- Describe other parts of software that are involved if any

Case 2: GPT-4 style

- Guesses on structure of the agents/LLMs that will interact

5. Comparison

Case 1, Old style:

- Describe a simple baseline model that you'll compare against
- Simple model or hand-coded heuristic

Case 2: GPT-4 style

- **You'll need a way to measure if system is succeeding**
- Often evaluated by hand; perhaps also by GPT-4 classifier

Proposal Document, cont'd

6. Plan
   - Discuss how you're going to work together
     - Especially important if you don't know each other well
   - List of sub-tasks
   - Your guess as to how much time each task will take
   - Use to create estimate of end-to-end time
7. Risks
   - Predict what might go wrong & how you'd recover

- Document also graded on structure, grammar and mechanics

Proposal Document, cont'd

- Hard Limit of 1200 words total
  - Doesn't count pictures or references
  - 1% penalty for every word in excess of 1200
  - Put word count and compute penalty on front cover of proposal
    - 5% penalty if this is missing
    - These words (the count & penalty) not included in count
- Due Monday November 5 at 9pm.
- Upload under Assignment – Project Proposal Document
  - Just one per group;
  - Quercus will know your group, it will be the name you selected in the approval-in-principal/uniqueness

Proposal Presentations

November 5/6, 2023

Proposal Presentation

Similar structure **but not same** as Document:

1. Introduction and Illustration
2. Data Collection and Processing
3. Architecture/Structure and Comparison
4. Risks
5. What You'll Have completed by November 18
   - At progress report time
   - Giving you a target to shoot at that **is not** the end

Proposal Presentation

- **4 minutes maximum to present**
  - **Timer** will be set & presentation ended at 4 mins.
  - 8 Slides **maximum** (including title slide)
  - Font size **minimum** 20
- This is difficult: must choose essential messages
- Urge you to practice the talk 2-3 times
  - Make sure you make sense to yourself and team
  - All team members must speak, roughly equally

Slides Due

- Slides due **Monday November 4th at 9pm**
  - Uploaded to Quercus ‘Assignment’ Proposal Presentation
  - Must be either **powerpoint (pptx)** or **PDF**
  - No google doc web links, must convert to pdf/pptx

Proposal Presentation

- I will put up the schedule of which team is presenting in which time slot

- Three possible times to present
  - November 5: During Regular Class: 10am-12 noon
    - **In usual classroom OI 2212**
  - Nov 5: Extra Evening Class: 6:00pm-9:00pm
    - **BA 1160 (Bahen Centre)**
  - Nov 6: Extra Evening Class: 6:00pm-9:30pm
    - **MS 2172 (Medical Sciences Building)**

Peer Review of Proposals/Presentations

- You will be asked to review another group's document and presentation
- You'll be scheduled to do that in a different time period, one of the three
- If you have a hard conflict with one of the periods, you must email me what it is and why
  - You must send that email by Monday October 28th at the latest

Questions?