



CMPT 413/713: Natural Language
Processing

Introduction 1

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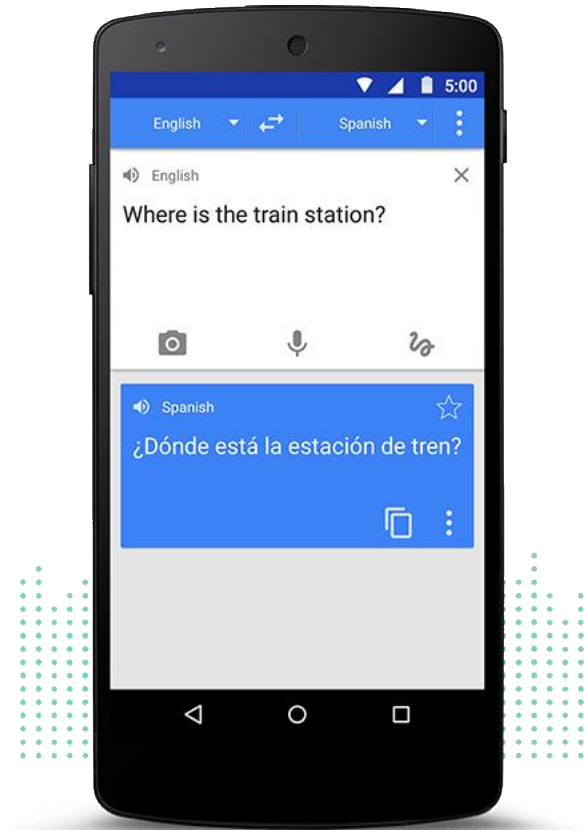
Today

- Intro to NLP
 - What is language? NLP vs computational linguistics.
- Course Logistics
- Quiz 30 min.

Next Lecture:

- Intro to Language Modeling

NLP is everywhere



Google translate



Virtual assistants

NLP is everywhere!



ChatGPT can answer all kinds of questions!

Can you explain how LLMs work?

Sure! Here's a clear, intuitive explanation of how Large Language Models (LLMs) work:

What an LLM is

A Large Language Model is a type of artificial neural network trained to understand and generate human-like text. Models like GPT learn patterns in language from massive amounts of text data.

How an LLM works (step by step)

1. Training on huge datasets

LLMs read billions of words—from books, websites, articles, etc.—and learn:

- grammar
- facts about the world
- writing styles
- how ideas relate to each other

They don't store exact copies of the text; instead, they learn statistical patterns in words.

2. Transformers: the core architecture

Modern LLMs use a structure called a **Transformer**, which has two key ideas:

Attention

Attention lets the model look at all words in a sentence at once and decide which predict the next word.

Example:

In the sentence "The cat that the dog chased escaped," attention helps the model connect "cat" ↔ "escaped" even though they are far apart.

Layers

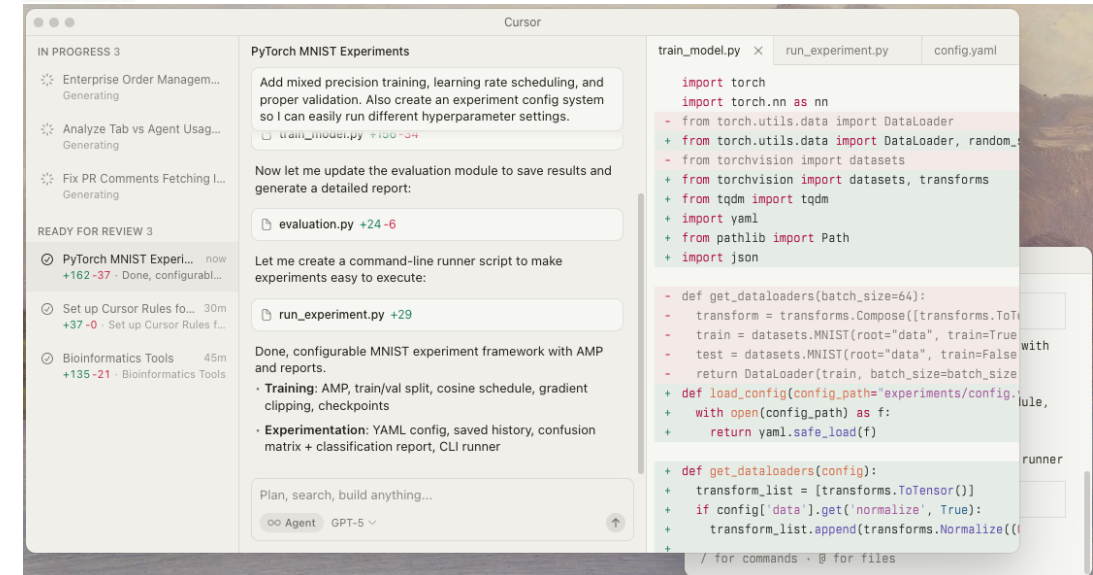
Transformers stack many attention layers.

Each layer learns more abstract patterns—first grammar, then meaning, then reasoning structures.

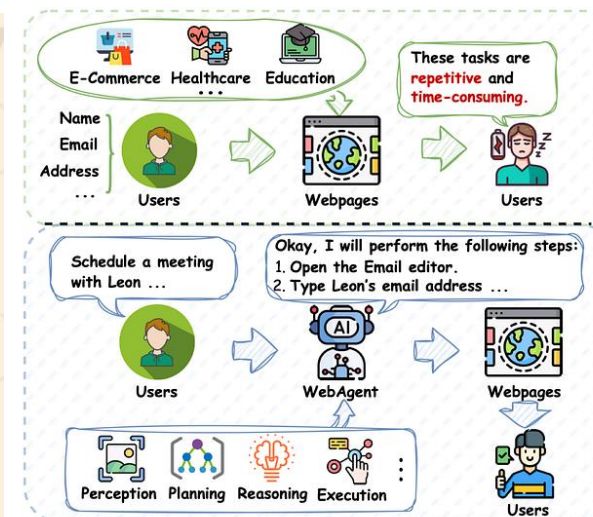
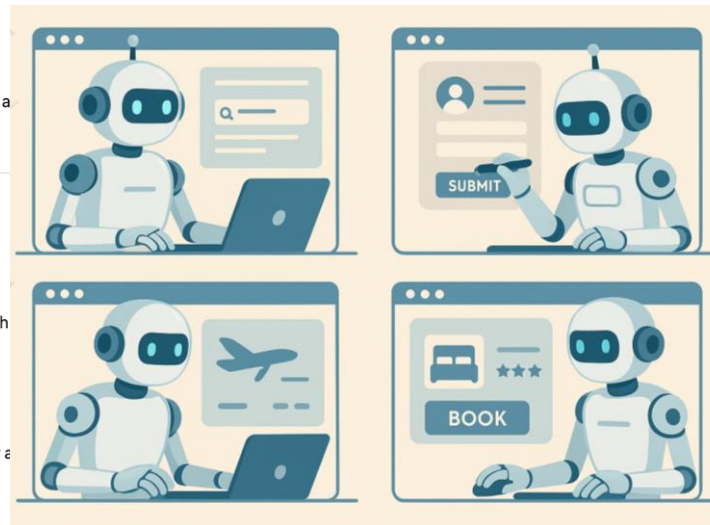


Cursor for coding

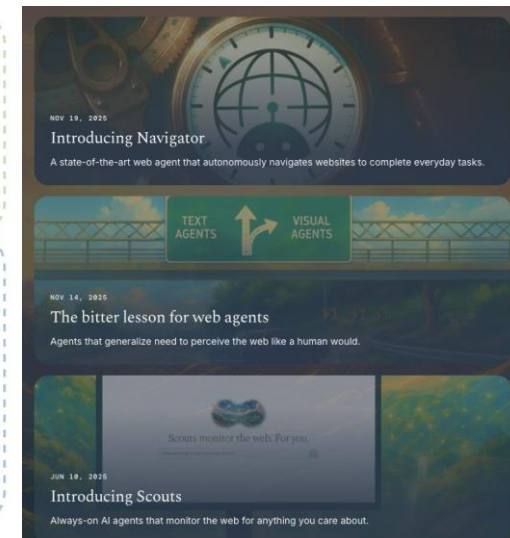
<https://cursor.com/>



LLM agents to automate tasks



<https://arxiv.org/pdf/2503.23350>



[Yutori](#)

Text to image generation

 **OpenAI** DALL-E 2

a painting of a fox sitting in a field at sunrise in the style of Claude Monet



<https://openai.com/dall-e-2/>

 **Imagen**

A cute sloth holding a small treasure chest.
A bright golden glow is coming from the chest.



<https://imagen.research.google/>

Try it out yourself: <https://huggingface.co/spaces/stabilityai/stable-diffusion>,
<https://www.craiyon.com/>, <https://www.midjourney.com/home/>

What is language?

- Language is used to communicate
 - Things, actions, abstract concepts



Natural Language Processing



Building **useful system** to process language

Course Logistics

Resources

- Website: <https://zhiyunrichardpeng.github.io/nlp-class/>
- Coursys: <https://coursys.sfu.ca/2026fa-cmpt-713-x1>

- TA office hours (see class website)
- Tutorial (optional)

Philosophy

- This is an **upper-level** undergrad / **grad level** class
- You are expected to **self-learn**
 - If you are not comfortable with that, you should not be in this class
- You will be learning material that is at the **cutting edge**
 - This will be exciting, but it will be challenging
- The class will be **math** and **machine learning** heavy
 - This is the “computational” part of computational linguistics and the “processing” part of NLP
 - These techniques will be useful outside of NLP
- We will focus on the **concepts** in lectures
 - The aim of the lectures is not to teach how to program or specific tools (shell, python, pytorch)
 - You are expected already know or self-learn (watch tutorial, get hands on practice)

Background / Prerequisites

No strict prerequisites. But you should know the following:

- Proficiency in **Python**
 - Programming assignments will be in python
 - numpy and pytorch will be used.
- **Calculus** and **Linear Algebra** (MATH 151, MATH 232/240)
 - You will need to be comfortable with taking multivariable derivatives
- Basic **Probability** and **Statistics** (CMPT 210 / STAT 270)
- Basic **Machine Learning** (CMPT 410/726)

There will be optional tutorials that will help review these topics.

Background / Prerequisites

If you don't have the necessary background, you will

- Find the class **HARD**
- If you have the programming and math background, but not the ML background and you still want to take the class, you should expect to spent **extra time** (~that of taking another course) to keep up with this class.
- Note: If you have taken CMPT 310 (Artificial Intelligence), it is NOT the same as having taken machine learning.

Grading

<https://zhiyunrichardpeng.github.io/nlp-class/>

Submitting Homework

- Homework are submitted online on Gradescope and Coursys
 - Gradescope : mainly for conceptual questions and reports
 - Coursys: for programming questions
- Conceptual homework will be a mix of multiple-choice and long-form answers.
 - Long-form answers should be written up **clearly and succinctly, by Overleaf.**
 - You may lose points if your answers are unclear or unnecessarily complicated

Collaboration Policy

- Programming Assignments
 - Done as a group 2-3 people.
 - Everyone should contribute (code, debugging, report writing)
 - If you do not contribute, you will get a 0
 - The contribution of each team member must be clearly described
- Conceptual assignments
 - These are individual assignments to be done by yourself

Quiz, mid-term and final

LLM policy

- Assignments
 - You are expected to learn about and use LLMs!
 - However, please try not to **copy answers directly** from LLM output for your reports and individual assignments
- If you use LLMs for helping writing up your answers
 - What is your initial attempt, what do LLMs correct regarding your answer, why, and what did you learn.
 - Make sure when you submit, you understand what you write.
 - You are responsible for any misrepresentation, factual inaccuracy or plagiarism in your materials.

Class Project

- Project should be a mini-research project. It can be:
 - Re-implementation of a recent NLP paper
 - Experimental comparison of several methods
 - More details later in the term
- Team of 2-3 students (same as programming homework groups)
- Graded components
 - See website.

Upcoming

- Basics of language modeling and text classification
- Tutorial (Self-learn) on
 - Probability, Linear Algebra and Calculus
 - Using Unix, python, numpy
- HW0 (4%) due: 9/18 (note: No grace period)
- Quiz

Q & A