Intro to deep learning

Dr. Janoś Gabler, University of Bonn

Lecture 1: Topic of Lecture 1

Am I in the right lecture?

- The course is called OSE Scientific computing
- Used to be just that
- This semester it is an intro to deep learning for NLP

ChatGPT

Examples

"Explain quantum computing in simple terms" →

"Got any creative ideas for a 10 year old's birthday?" →

"How do I make an HTTP request in Javascript?" →

Capabilities

Remembers what user said earlier in the conversation

Allows user to provide follow-up corrections

Trained to decline inappropriate requests

Limitations

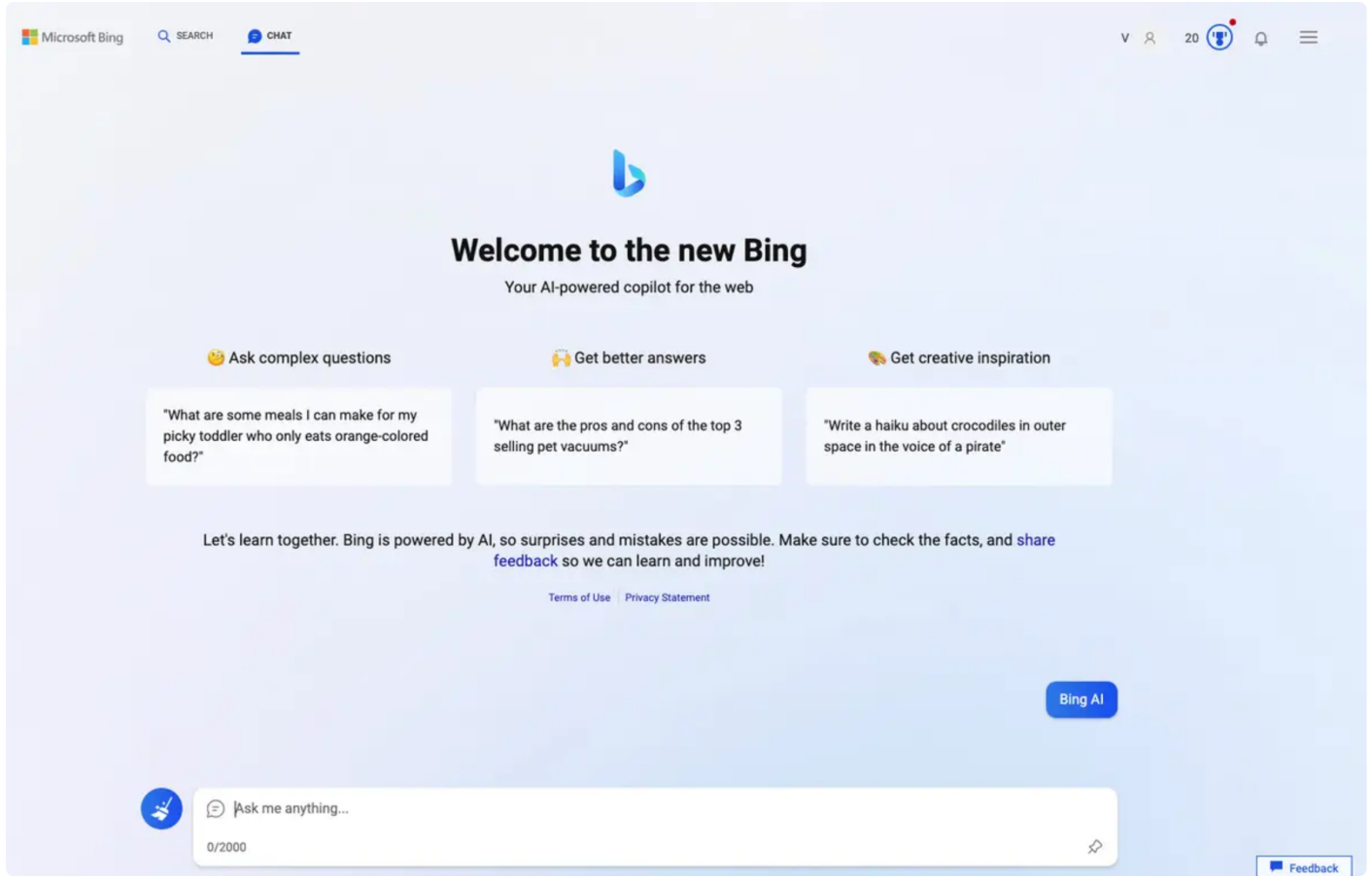
May occasionally generate incorrect information

May occasionally produce harmful instructions or biased content

Limited knowledge of world and events after 2021

Send a message...


GitHub
Copilot


Microsoft Bing
SEARCH
CHAT
V
20
Welcome to the new Bing
Your AI-powered copilot for the web
Ask complex questions
Get better answers
Get creative inspiration
"What are some meals I can make for my picky toddler who only eats orange-colored food?"
"What are the pros and cons of the top 3 selling pet vacuums?"
"Write a haiku about crocodiles in outer space in the voice of a pirate"
Let's learn together. Bing is powered by AI, so surprises and mistakes are possible. Make sure to check the facts, and share feedback so we can learn and improve!
Terms of Use
Privacy Statement
Bing AI
Ask me anything...
0/2000
Feedback

NEWS | 08 December 2022

Are ChatGPT and AlphaCode going to replace programmers?

OpenAI and DeepMind systems can now produce meaningful lines of code, but software engineers shouldn't switch careers quite yet.

Davide Castelvecchi

Artificial intelligence (AI) researchers have been impressed by the skills of AlphaCode, an AI system that can often compete with humans at solving simple computer-science problems. Google sister company DeepMind, an AI powerhouse based in London, released the tool in February and has now published its results in *Science*[1], showing that AlphaCode beat about half of humans at code competitions.

What is NLP

- Text classification
- Named Entity Recognition
- Question answering
- Summarization
- Translation
- Text generation

Econ Applications

- Classify political speeches along the political spectrum
- Classify tweets to see how opinions change over time
- Extract concepts (named entities) that are mentioned in a free form reply in a questionnaire
- Translate questionnaires or answers
- ...
- $\Rightarrow$ huge potential to use new data sources

Lecture Plan: Part 1

- **Lecture 1**: Overview, logistics and installation
- **Lecture 2**: Python, Jupyter, Git and Markdown basics
- **Lecture 3**: Intro to huggingface ecosystem and different NLP tasks
- **Lecture 4**: Classification with sklearn
- **Lecture 5**: Tokenization
- **Lecture 6**: Text classification via feature extraction
- **Lecture 7**: Text classification via fine-tuning
- $\Rightarrow$ Focus on practical skills
- $\Rightarrow$ After this, you are able to learn how to do other NLP tasks on your own

Lecture Plan: Part 2

- **Lecture 8:** Feedforward neural networks from scratch
- **Lecture 9:** (Pre-)training neural networks
- **Lecture 10:** RNNs, attention and transformers
- **Lecture 11:** Model architectures and loss functions
- **Lecture 12:** Final Projects tips / Bonus lecture
- $\Rightarrow$ Focus on understanding
- $\Rightarrow$ After this you are able to learn how to do other deep learning tasks on your own

Practical goals

Students are able to ...

- ... solve standard NLP tasks using pre-trained models from *huggingface*
- ... fine-tune NLP models using *huggingface-transformers*
- ... select the right model for a task on *huggingface-hub*
- ... embed the use of NLP models into their empirical projects
- ... share their work using git and GitHub
- ... implement and train basic neural networks in pytorch
- ... Run Python code locally, on JupyterHub and google colab

Knowledge goals

Students know ...

- ... what happens inside a feed-forward neural network
- ... how neural networks are trained
- ... the difference between CNNs, RNNs and transformer models
- ... what pre-training and fine tuning are
- ... which tasks can be solved with NLP models

Personal goals

Students ...

- ... communicate effectively about problems that arise while coding
- ... look at complex topics at different levels of abstraction
- ... help each other to fix problems and understand concepts
- ... are confident they can tackle NLP problems that arise in their research
- ... become interested in learning more about reproducible research

This course will not theach you

- How to train GPT-sized models
- How to become a professional Python programmer
- How to automate research projects (EPP is for that)

Lecture Style

- We present material in small portions, often with code examples (5 - 10 min)
- You apply the concepts in practice (5 - 10 min, it’s ok if you don’t finish)
- We present the solution and answer questions (5 min)
- You deepen your knowledge at home with optional exercises
- You apply your knowledge in your final project

You are responsible for your learning

- You get solutions for all exercises immediately
- You decide whether do exercises at home (no bonus points)
- You decide if you want to work in groups and with whom
- You decide if you use additional resources we provide for each topic

This is a team effort

- If anyone asks you for help, you try to help
- If you know the answer to a question on zulip before we get to it, you reply
- If you have a question, you ask it in public so everyone benefits
- If you solved a problem others might have, you post it on zulip
- If you are between grades in the end, this can make a difference

Course logistics

Why do you want to take this class?

1. To use NLP in econ research
2. To find a job in NLP
3. To become better at programming
4. To get credits
5. Don’t want to take the class
6. Other

Do you have previous knowledge in machine learning?

1. Deep learning expert
2. Seasoned user of sklearn or similar
3. Ran a lasso once
4. Never used it

What is your previous Python knowledge?

1. Expert in Python and all machine learning related libraries
2. Advanced Python user
3. Can usually get stuff done
4. Some experience with Python
5. Never used it

If you have done deep learning or NLP projects before, what have you struggled with?

Questions about

- Credits and grades
- Topics covered
- Other

Running Python

Python functions

```
>>> def add(a, b):
>>>     return a + b

>>> add(1, 2)
3
```

```
>>> print("I like programming!")
I like programming!
```

- Functions are defined with def
- In brackets you define the arguments of the function
- `print` is a built-in function
- Functions can call other functions

Task 1

(5 min)

Python strings

```
>>> a = "Hello"
>>> b = "3"
>>> c = 3
```

```
>>> f"{a} {b}"
Hello 3
```

```
>>> d = "a_b_c_d"
>>> d.split("_")
['a', 'b', 'c', 'd']
```

- A string variable is defined with single or double quotes
- String variables hold text
- A string 3 is not the same as an int 3
- You can format strings if you prefix them with an `f`
- You can split strings with the split method
- Strings have many more methods

Task 2

(5 min)

Python dictionaries

```
>>> letter_to_position = {
...     "a": 0,
...     "b": 1,
...     "c": 2,
... }
>>> letter_to_position["c"]
2
```

```
>>> for key in letter_to_position:
...     print(key)
a
b
c
```

```
>>> for key, pos in letter_to_position.items():
...     print(key, pos)
a 0
b 1
c 2
```

- Dictionaries map keys to values
- You can look up values with square brackets
- By default, loops iterate over keys
- You can use `` `.items` `` to loop over keys and values

Task 3

(8 min)

Python lists

```
>>> a = [1, 2, 3]
>>> a[1]
2
```

```
>>> a.append(4)
>>> a
[1, 2, 3, 4]
```

- Lists are created with square brackets
- List can hold arbitrary othe variables
- You can access list elements by position with square brackets
- Indexing starts at 0
- You can add elemnts with the append method

Task 4

(5 min)