Neural Networks from Scratch

PyTorch Review

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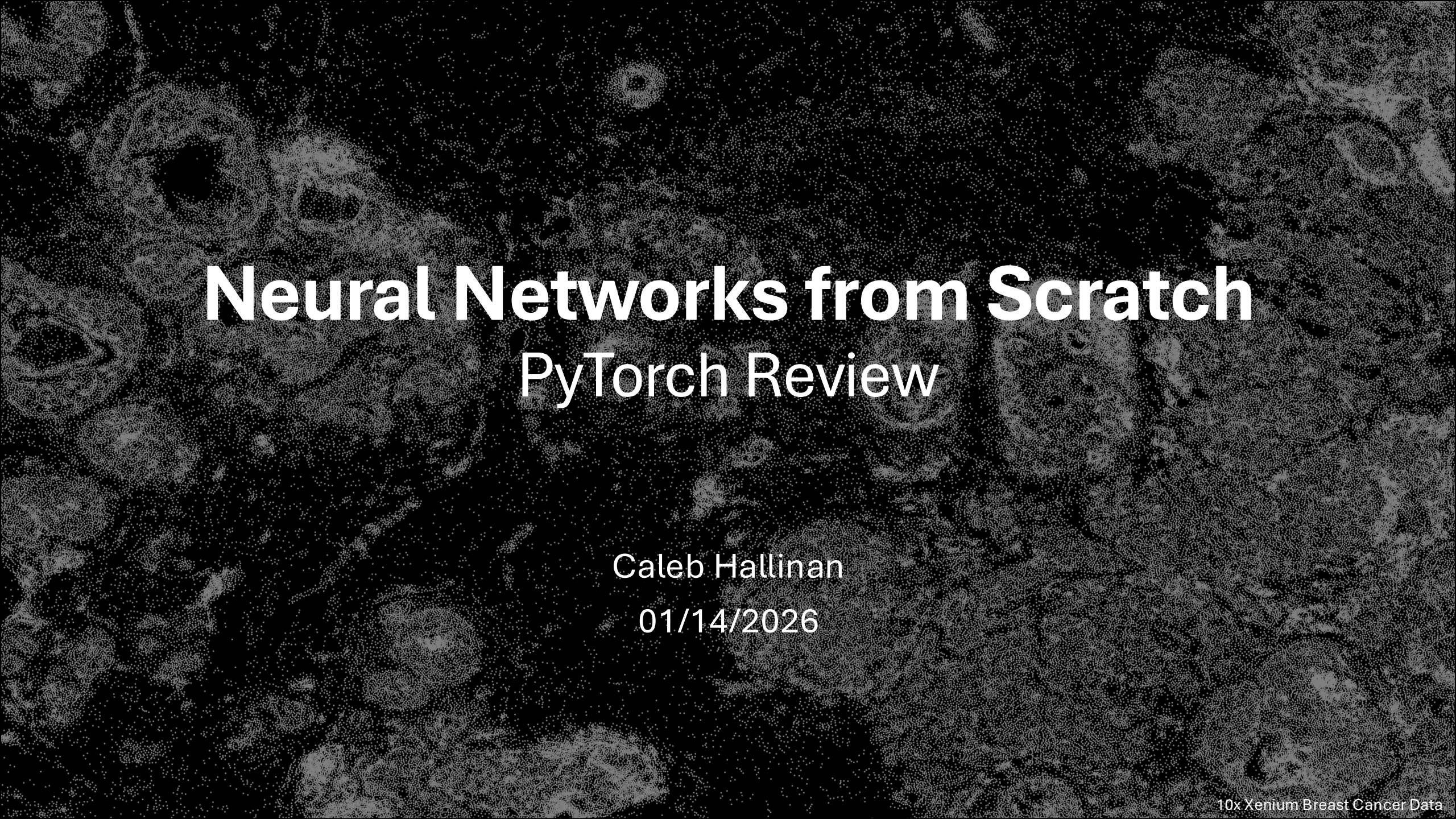
01/14/2026



10x Xenium Breast Cancer Data

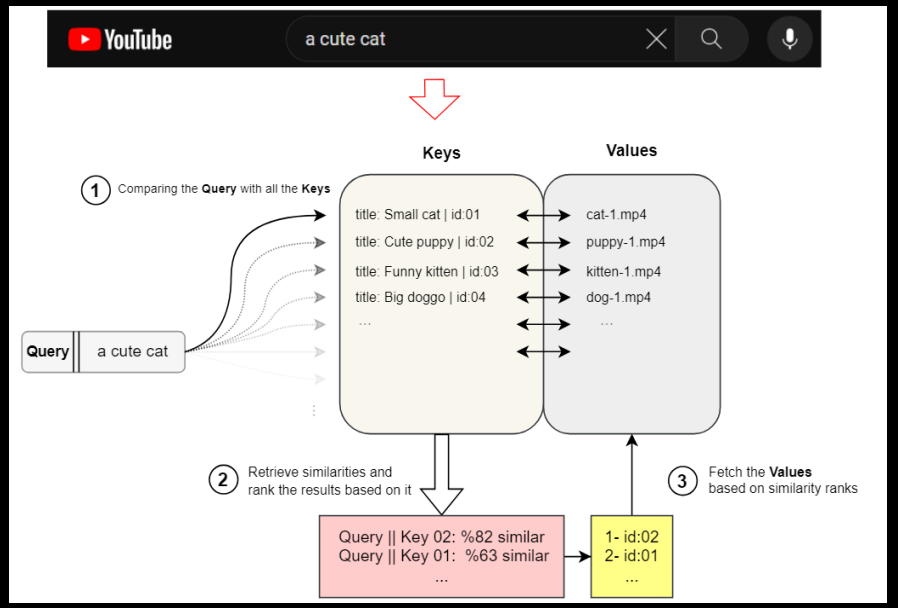
Announcements

- Lecture and code from yesterday is on GitHub
- Project is out, tomorrow is a workday for the project
- Today we will do a PyTorch review – practice on a few datasets

A few questions from reflection cards

Understanding Q,K,V

- A Transformer learns how to ask good questions (Q), how to index information (K), and how to move meaning around (V)
  - a query (what am I looking for?)
  - a key (what do I offer?) – where to look
  - a value (what information I carry or what do I contribute?) – what to take



https://epichka.com/blog/2023/qkv-transformer/

Are tokens only words and punctuation, or can words be split into multiple tokens?

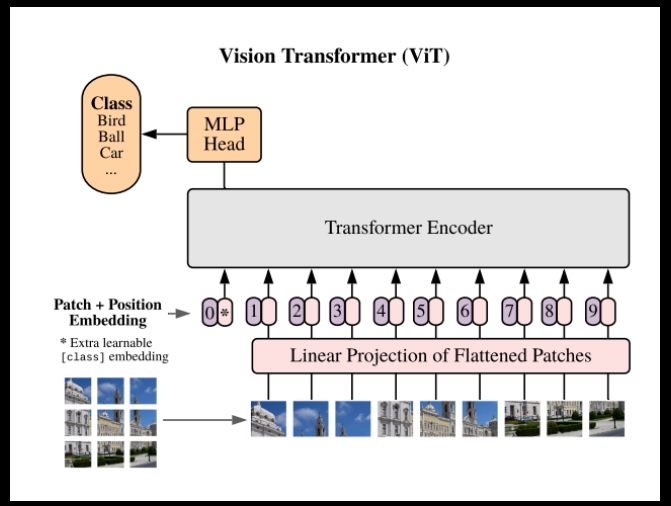
- A token is a unit from the model’s vocabulary, not a linguistic word
- Most modern LLM use subword tokens
  - So say our word is “unbelievably”
    - Possible subtokens are ["un", "believ", "ably"]
- Tokens are learned text chunks that statistically make sense, not linguistic words
  - Optimized for frequency and efficiency

How can transformers can respond to text it hasn't seen before (even gibberish)

- Transformers can respond to unseen or gibberish text because they operate on learned structure over tokens, not memorized examples
- Transformers do not learn sentences, they learn statistical structure over tokens
  - So even with unseen text or gibberish, all they are doing is predicting the likelihood of the next token (whether that is a word, subword, etc.)

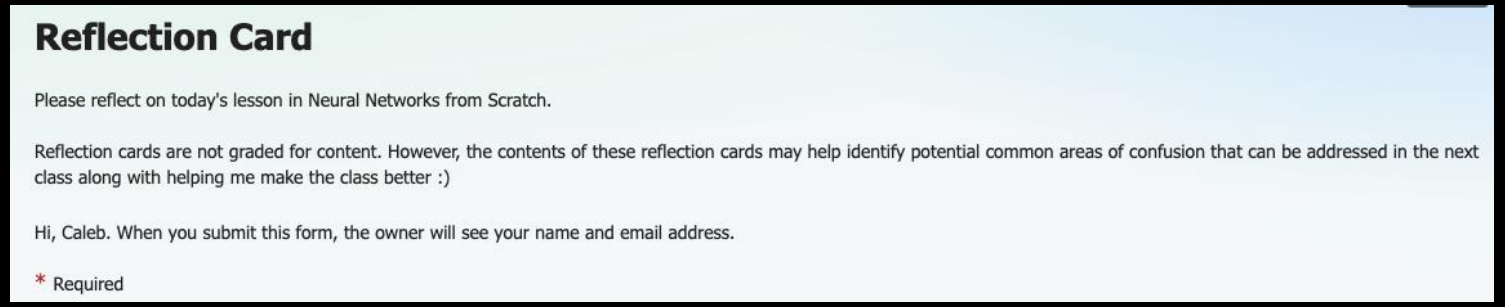
Why do some models use encoder only while others use decoder only architectures

- Models choose encoder-only, decoder-only, or both based on whether they need to understand, generate, or transform text
  - Encoder understands the input
  - Decoder generates output
- For Vision Transformers, only an encoder is used because we want to understand the input, then a small MLP is used to do classification



PyTorch review

Reflection Cards



Reflection Card

Please reflect on today's lesson in Neural Networks from Scratch.

Reflection cards are not graded for content. However, the contents of these reflection cards may help identify potential common areas of confusion that can be addressed in the next class along with helping me make the class better :)

Hi, Caleb. When you submit this form, the owner will see your name and email address.

* Required

- Essentially a means to help me make this class better!
  - Would you be interested in a hybrid version of class?

1. What is something that you learned in today's lecture?
2. What is something that you are still confused about from today's lecture?
3. Do you have any other comments/feedback/thoughts/suggestions/concerns?

https://forms.office.com/r/Kv8LtW4iJH