Deep Learning for Sequences

UTMIST Study Group - Module 5
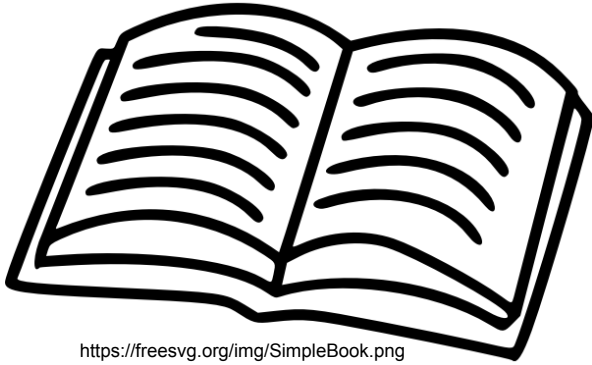
Agenda
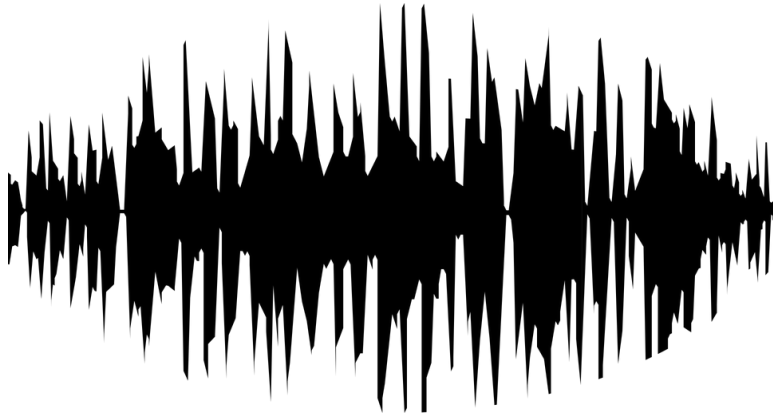
Recurrent Neural Networks

- Motivation
- Architecture
- Training
- LSTM
- GRU
- Applications

Sequences are Everywhere

https://freesvg.org/img/abustany_Movie_reel.png

https://freesvg.org/img/SimpleBook.png

https://freesvg.org/img/1449602440.png

https://www.maxpixel.net/static/photo/1x/Sfa-Jazz-Music-Wave-Sound-Audio-1293262.png

Sequential Memory

- Try saying the alphabet in forwards or backwards order. Which one is easier?
- Start saying the alphabet at G. Did you struggle with the first few letters but got easier afterwards?

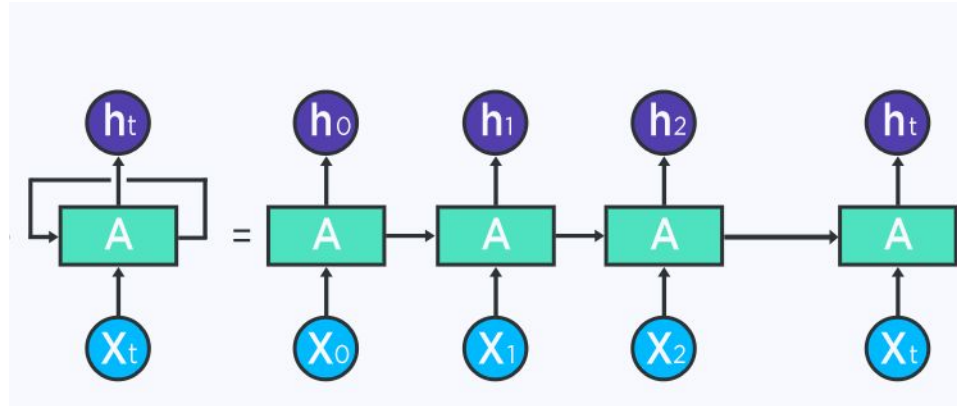**A B C D E F <u>G</u> H I J K L M N O P Q R S T U V W X Y Z**

RNN Architecture

- Previous output used as input
- Process input of arbitrary length
- Weight shared across time
- Illustrated example

https://upload.wikimedia.org/wikipedia/commons/b/b5/Recurrent_neural_network_unfold.svg
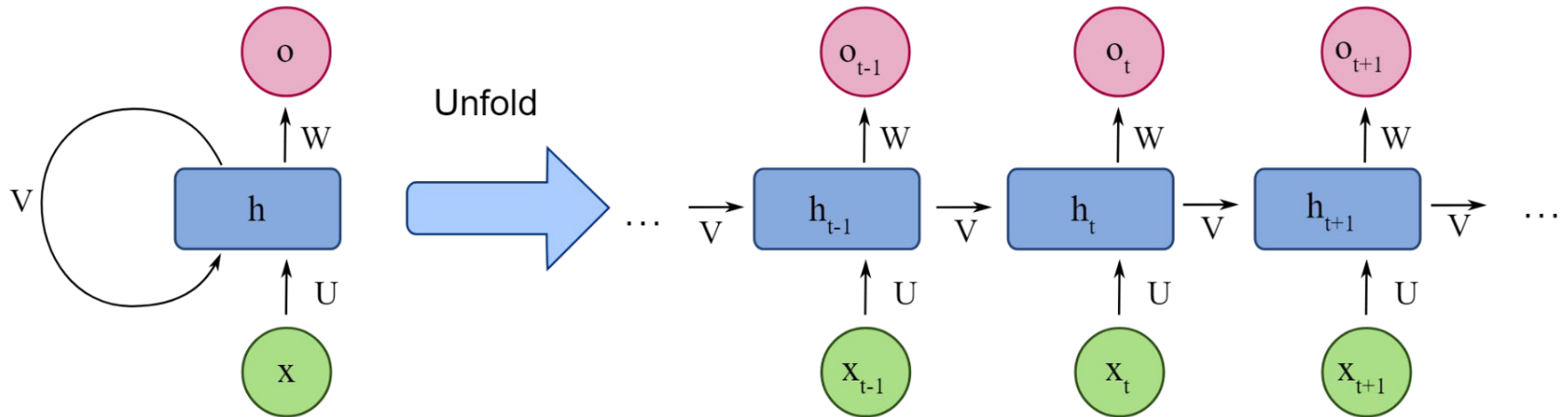
Backpropagation Through Time

1. Unroll RNN through time
2. Back propagate error from last to first time step
3. Calculate error at each time step
4. Update weight at each time step

https://cdn.builtin.com/sites/www.builtin.com/files/styles/ckeditor_optimize/public/inline-images/national/unrolled-rnn_0.png

Vanishing Gradient Problem

- Short-term memory
- In back-propagation, gradient calculation is dependent on previous layer
- This causes gradient and weight adjustment to shrink

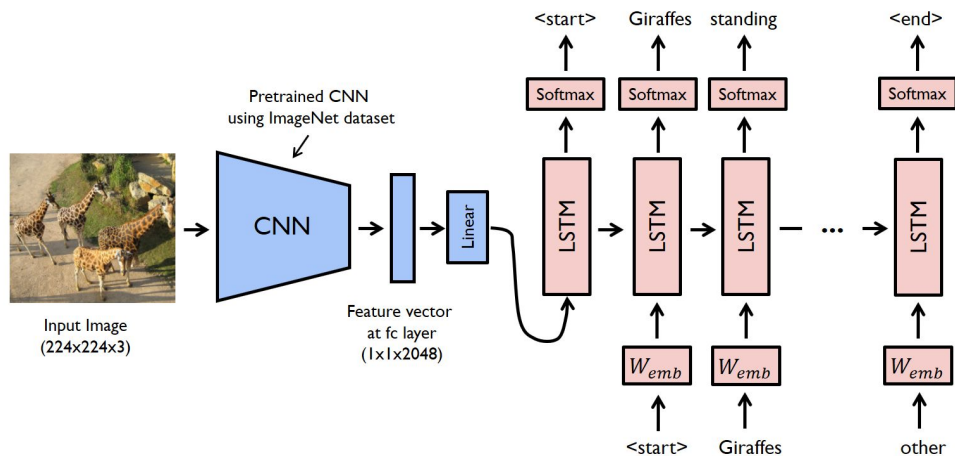https://miro.medium.com/max/1200/1*Ku54qmCryZVBaIc6g8rjGA.gif

Solution: LSTM & GRU

- Long Short Term Memory (LSTM) & Gated Recurrent Unit (GRU)
- Gates that selectively update long-term memory
- Illustrated example
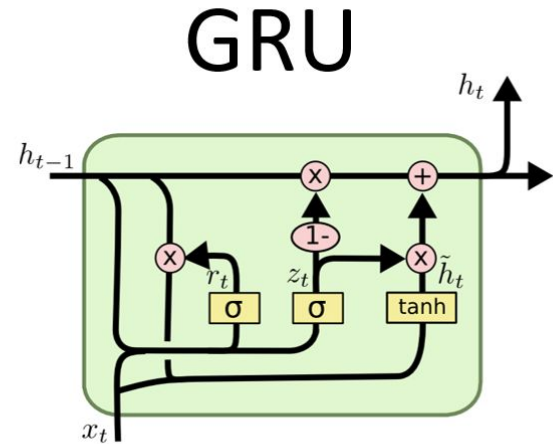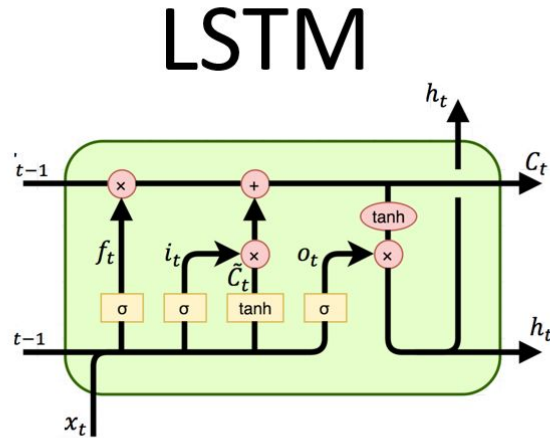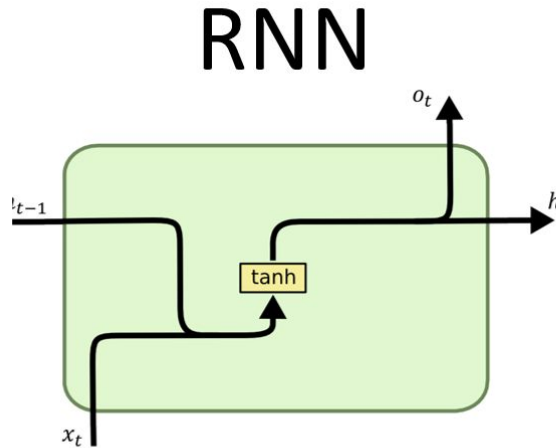
Applications

- Sequence generation: music generation, image captioning
- Sequence classification: sentiment analysis
- Sequence translation: machine translation, speech to text
- Check our study group's GitHub page for useful links

Thank You! :)