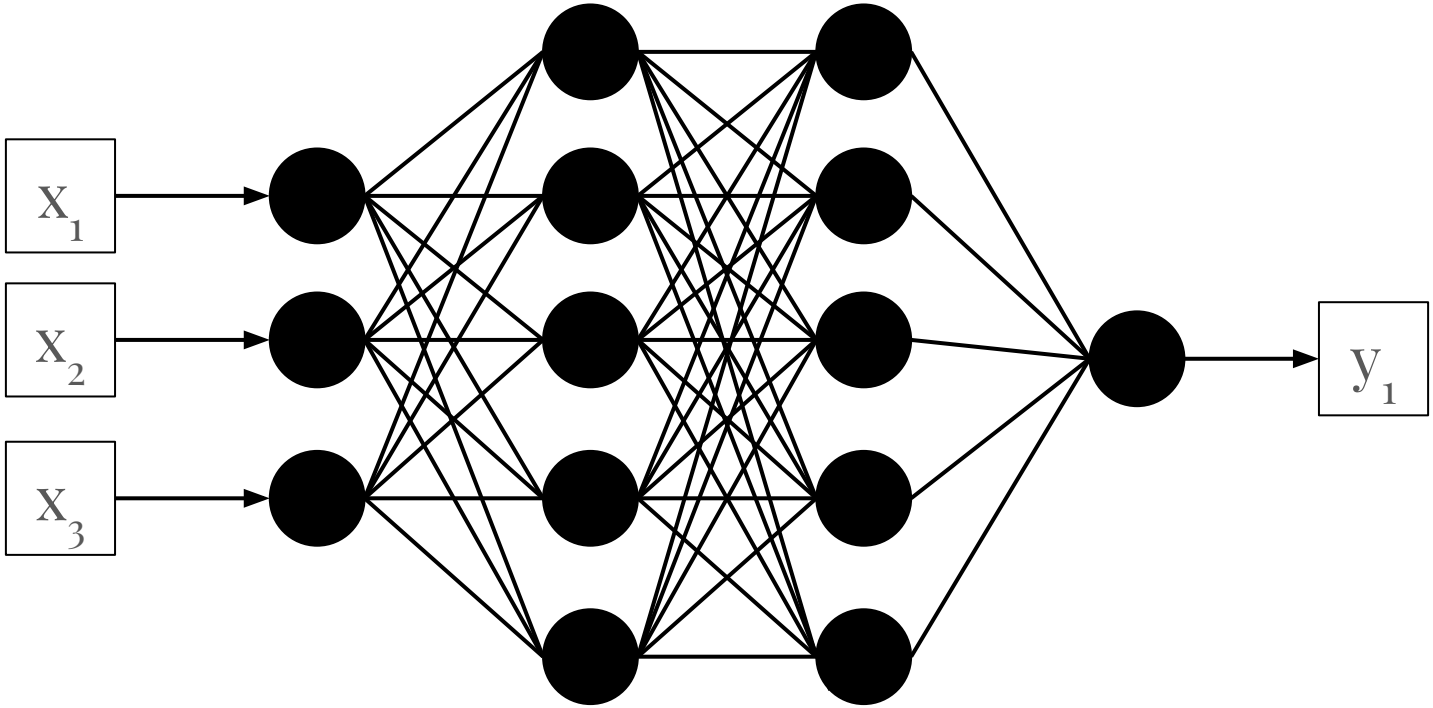
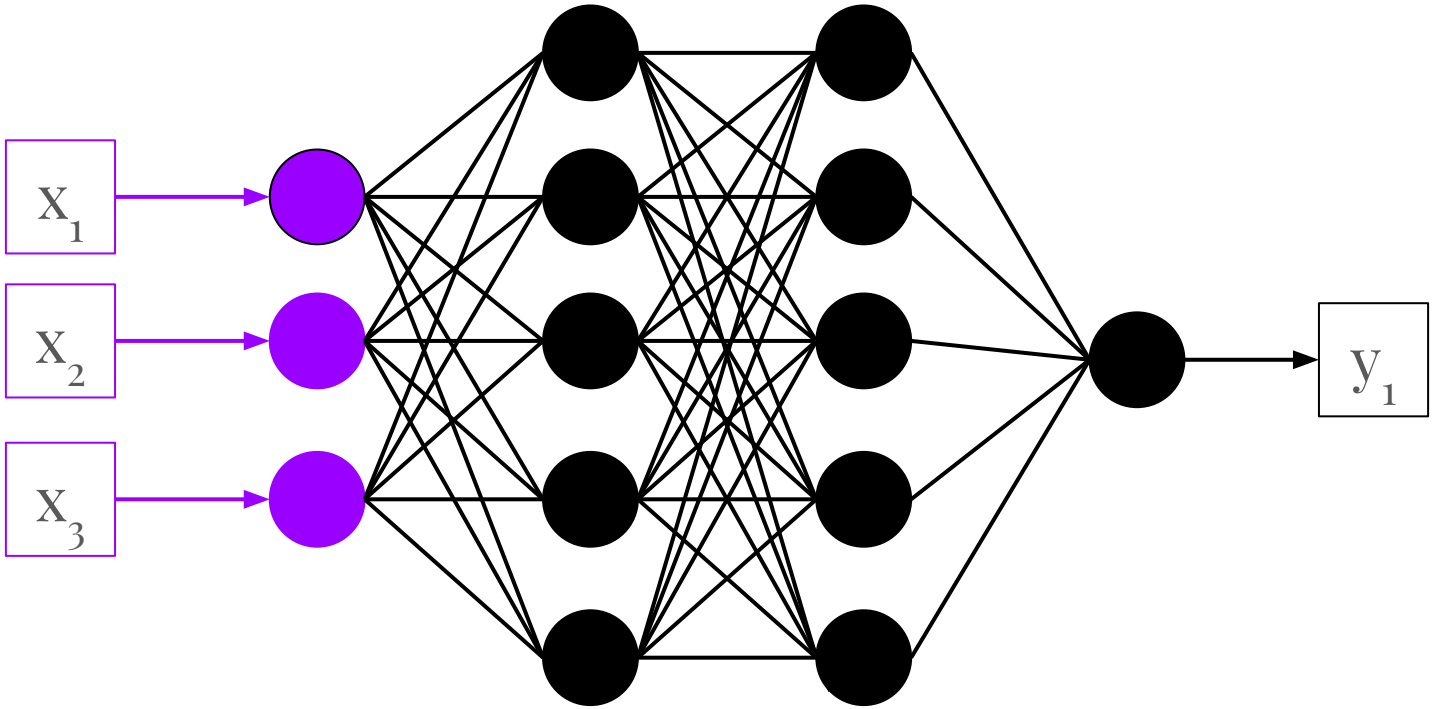
Transformers and Large Language Models (LLMs)

Dr. Julie Butler
DSC 340 Week 13 Slides

Neural Networks



Feedforward Neural Network



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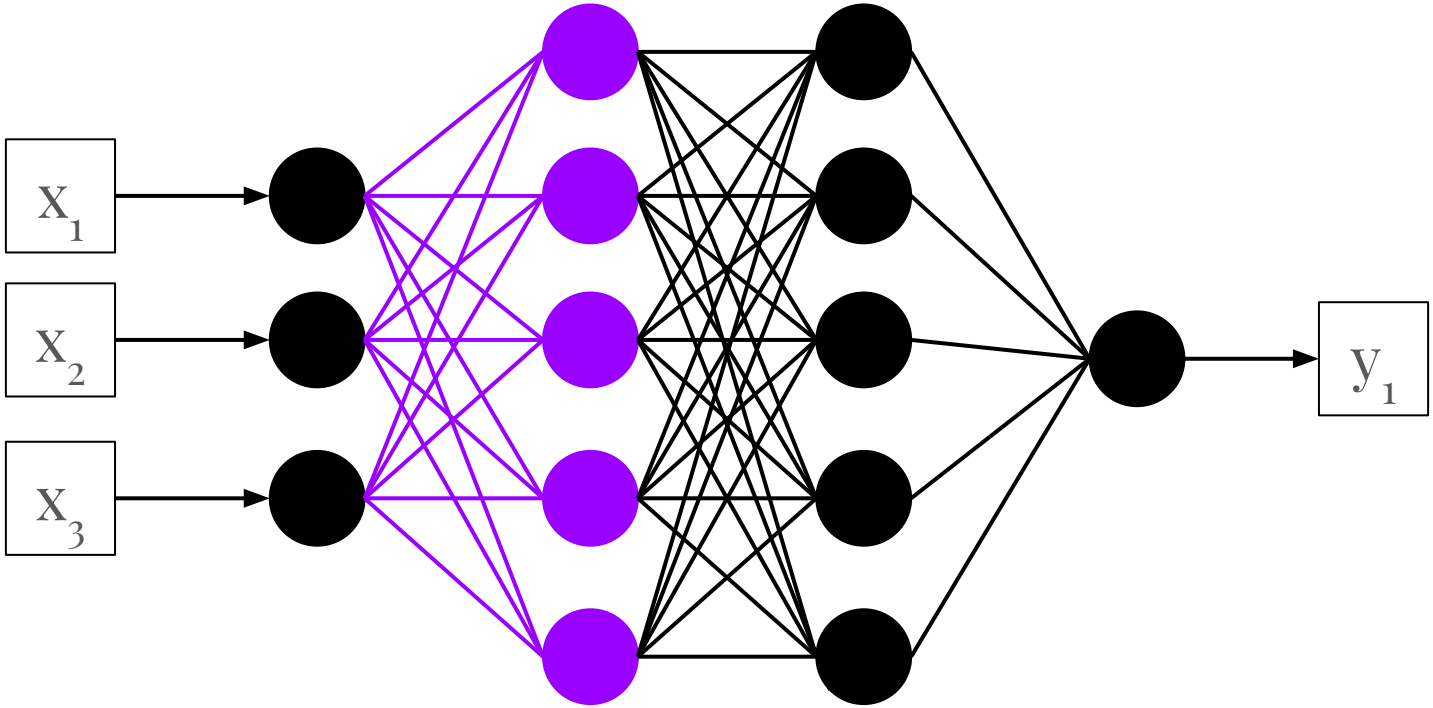

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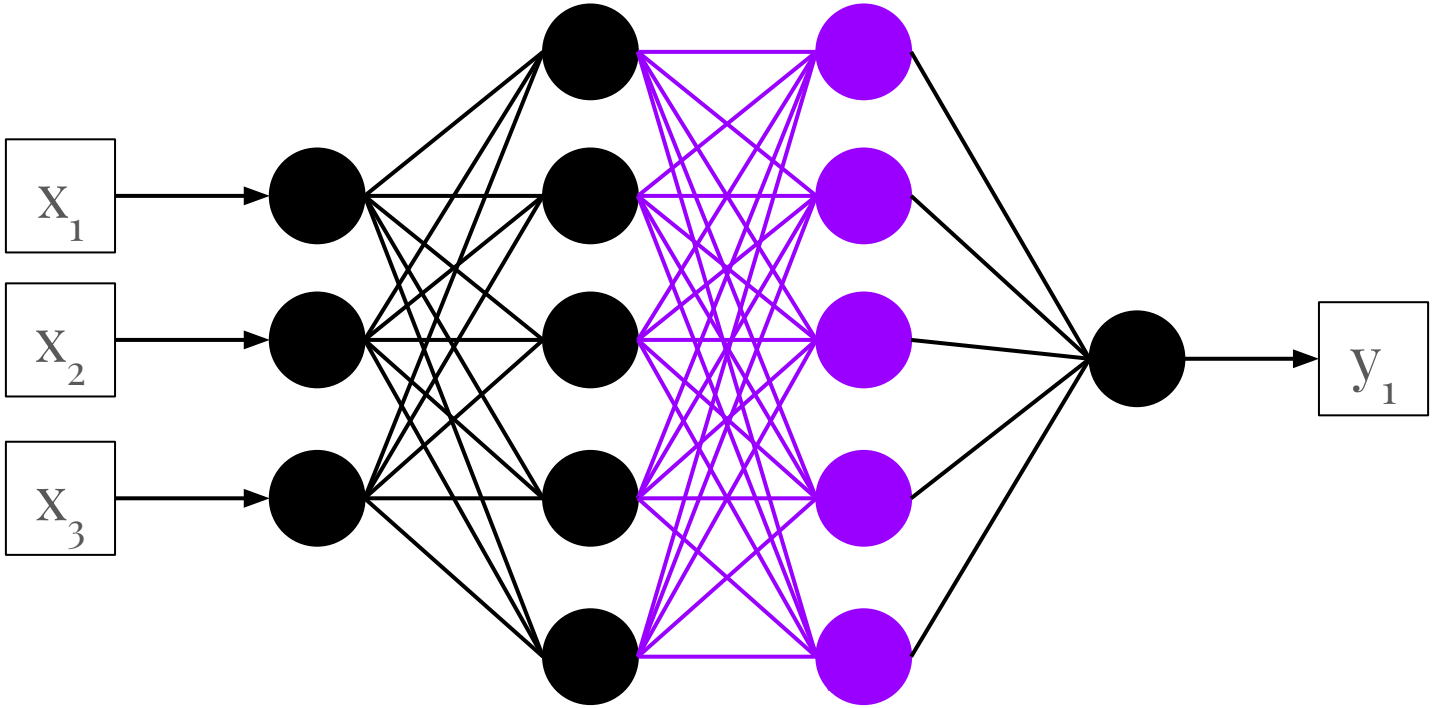

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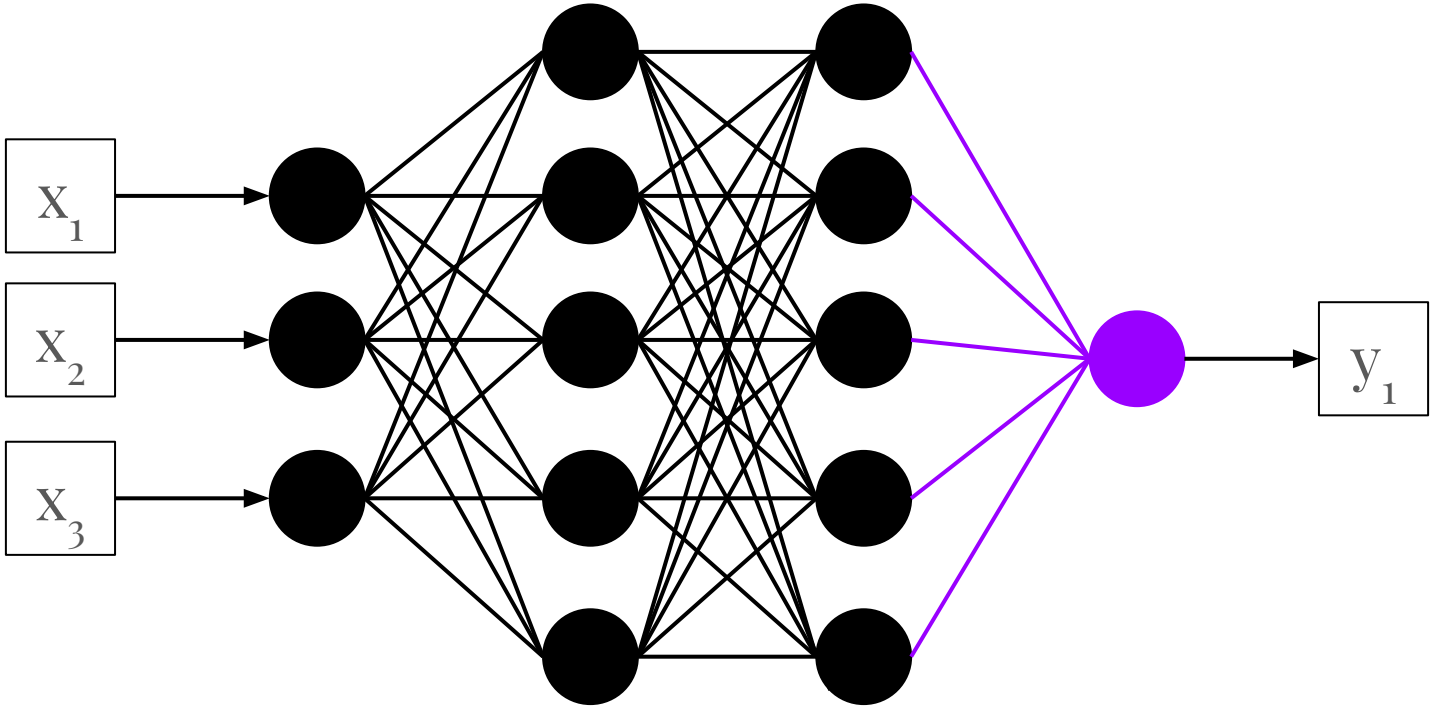

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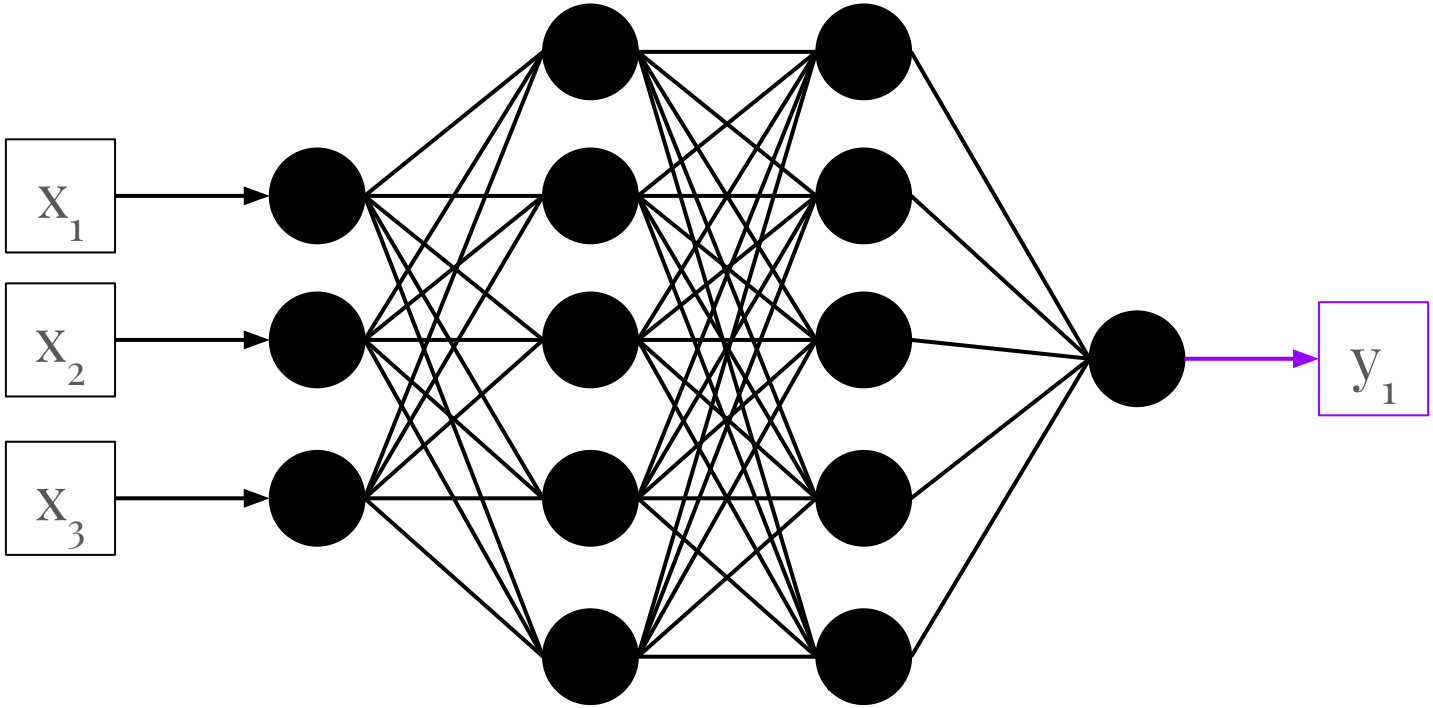

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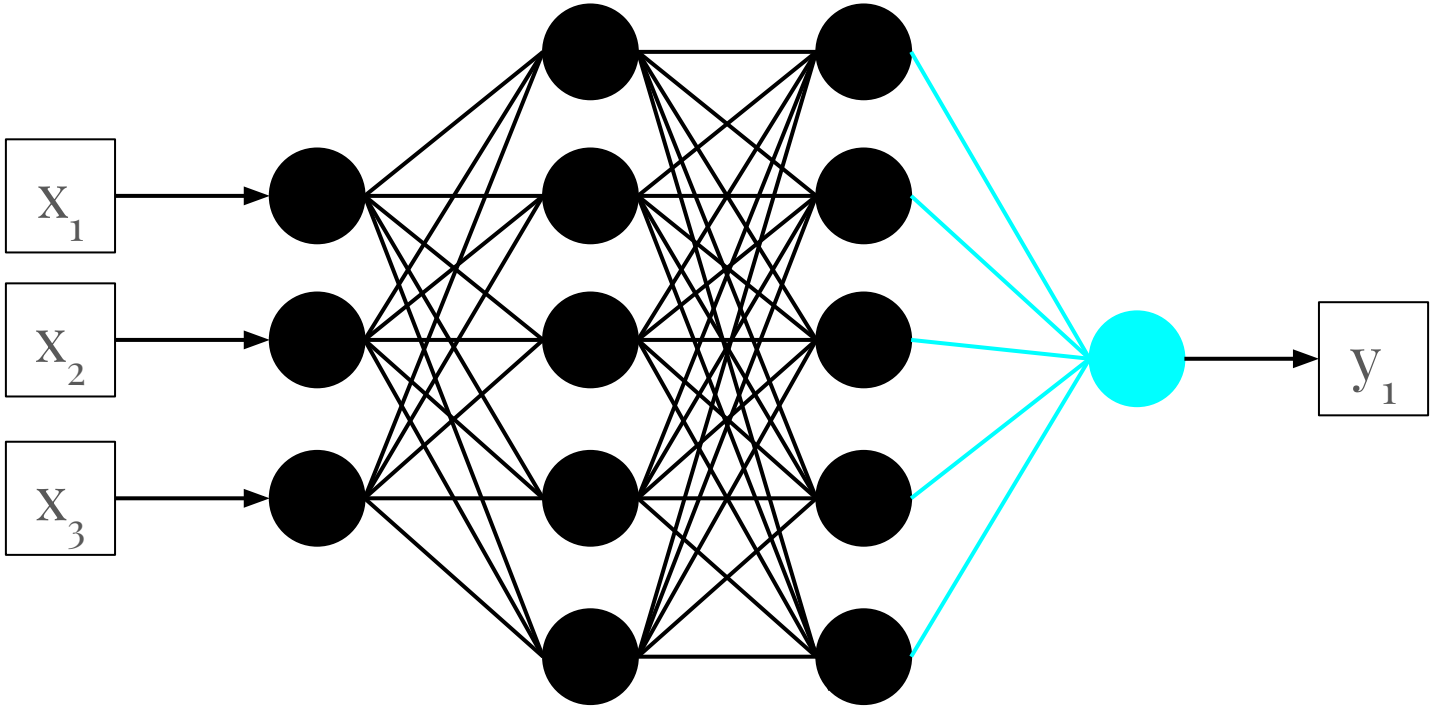

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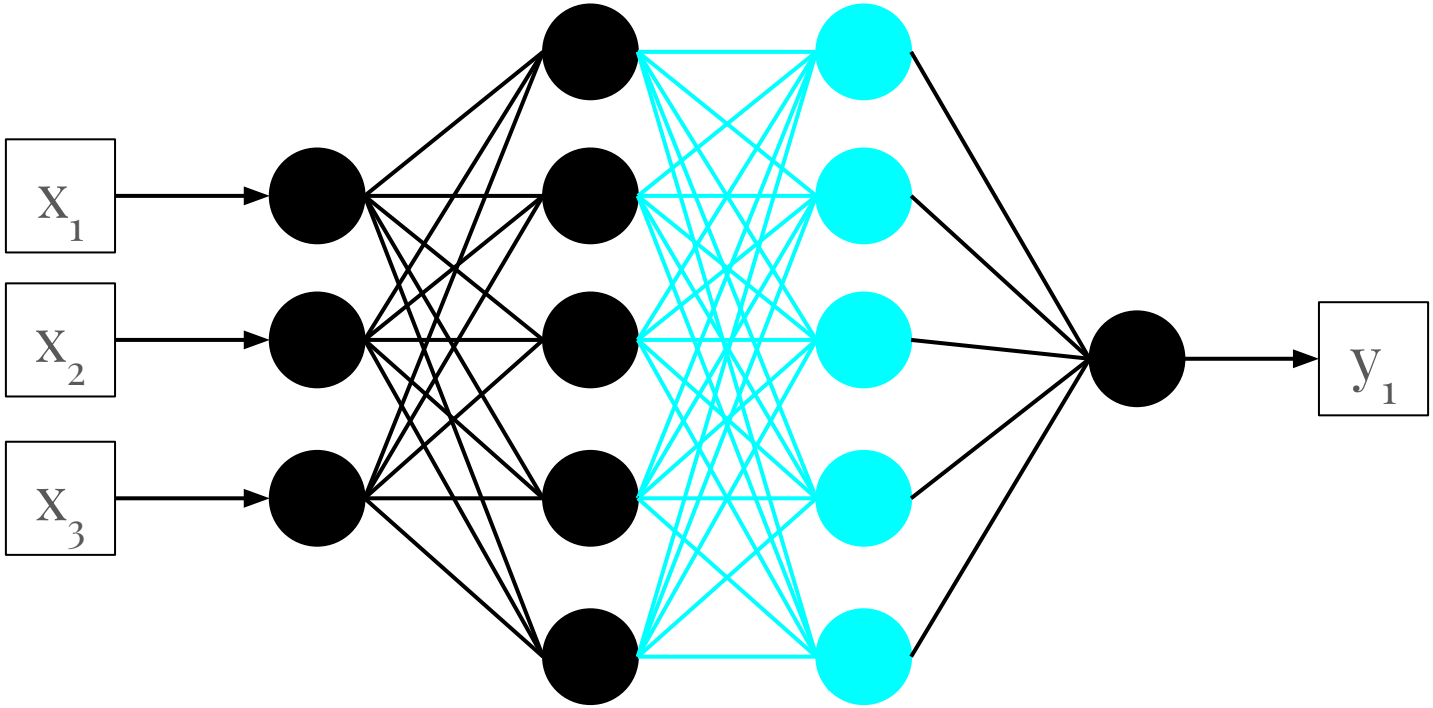

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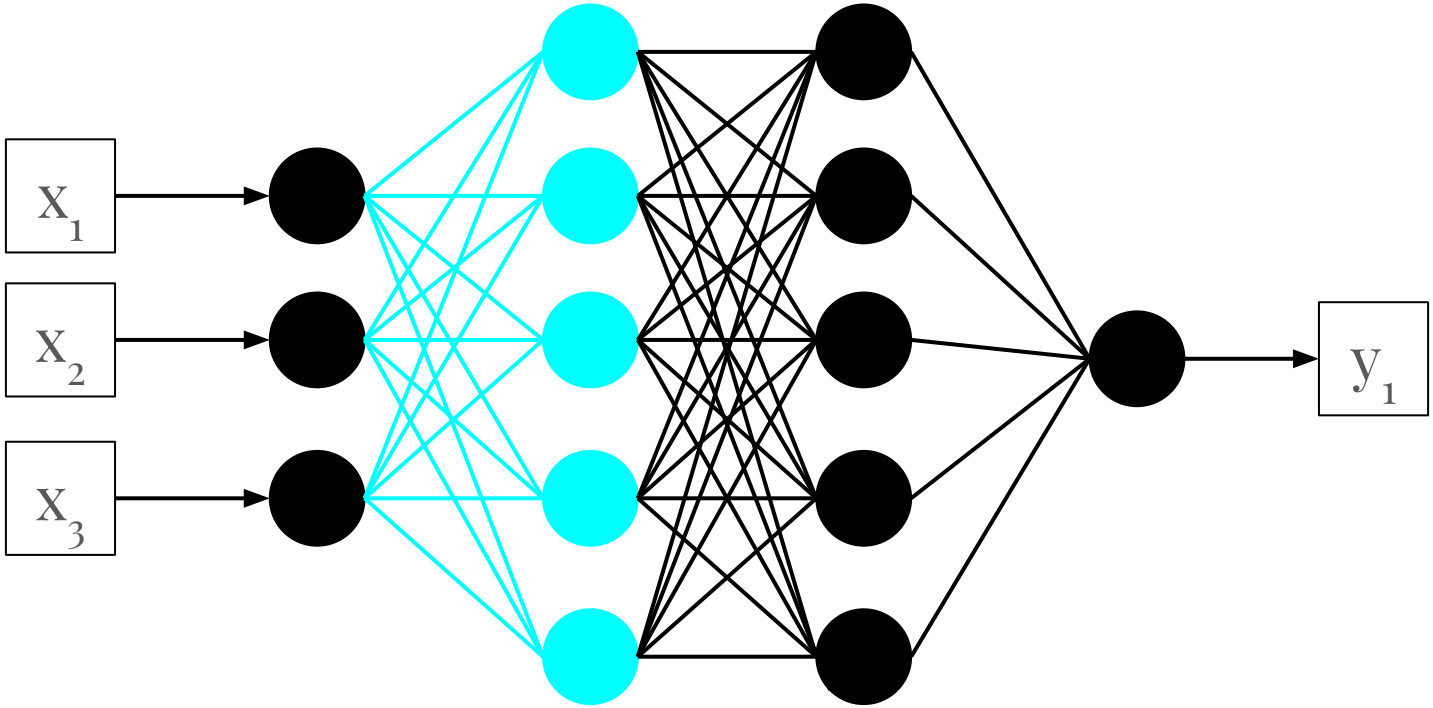

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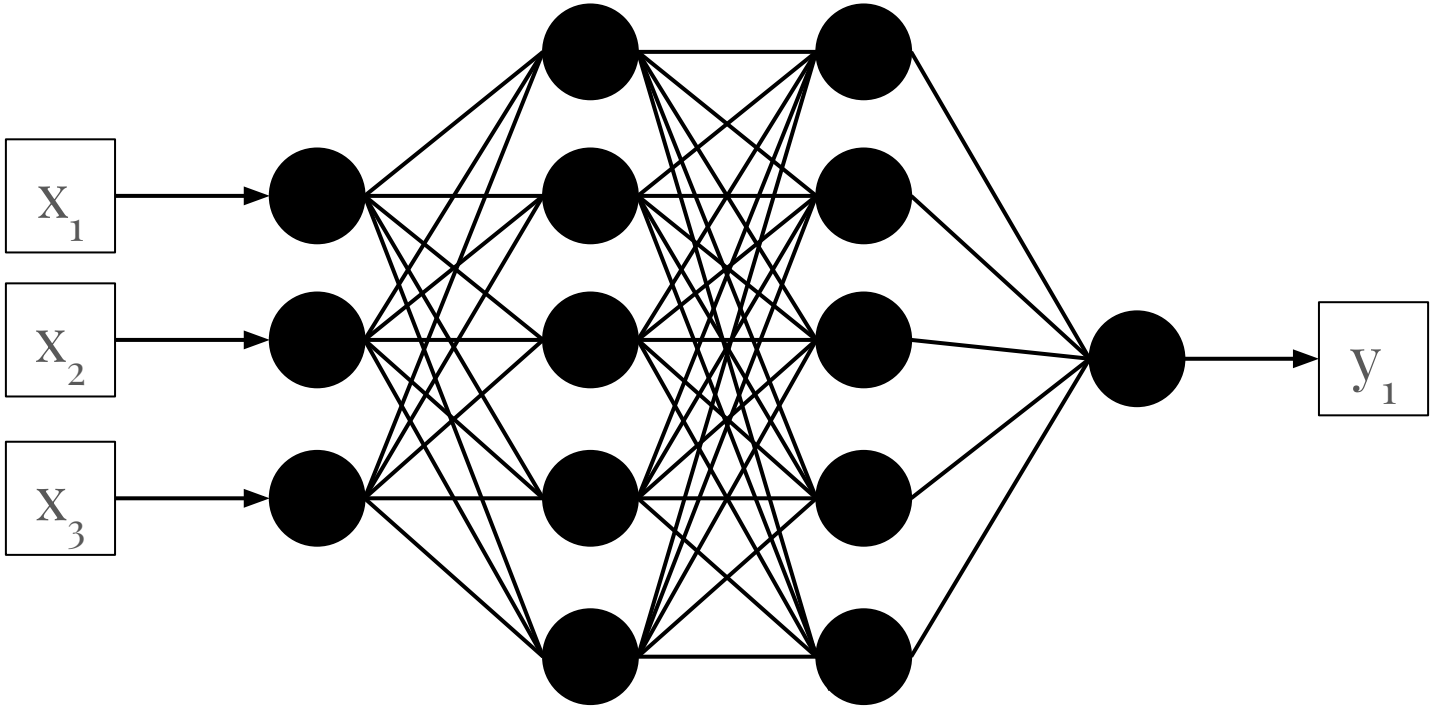
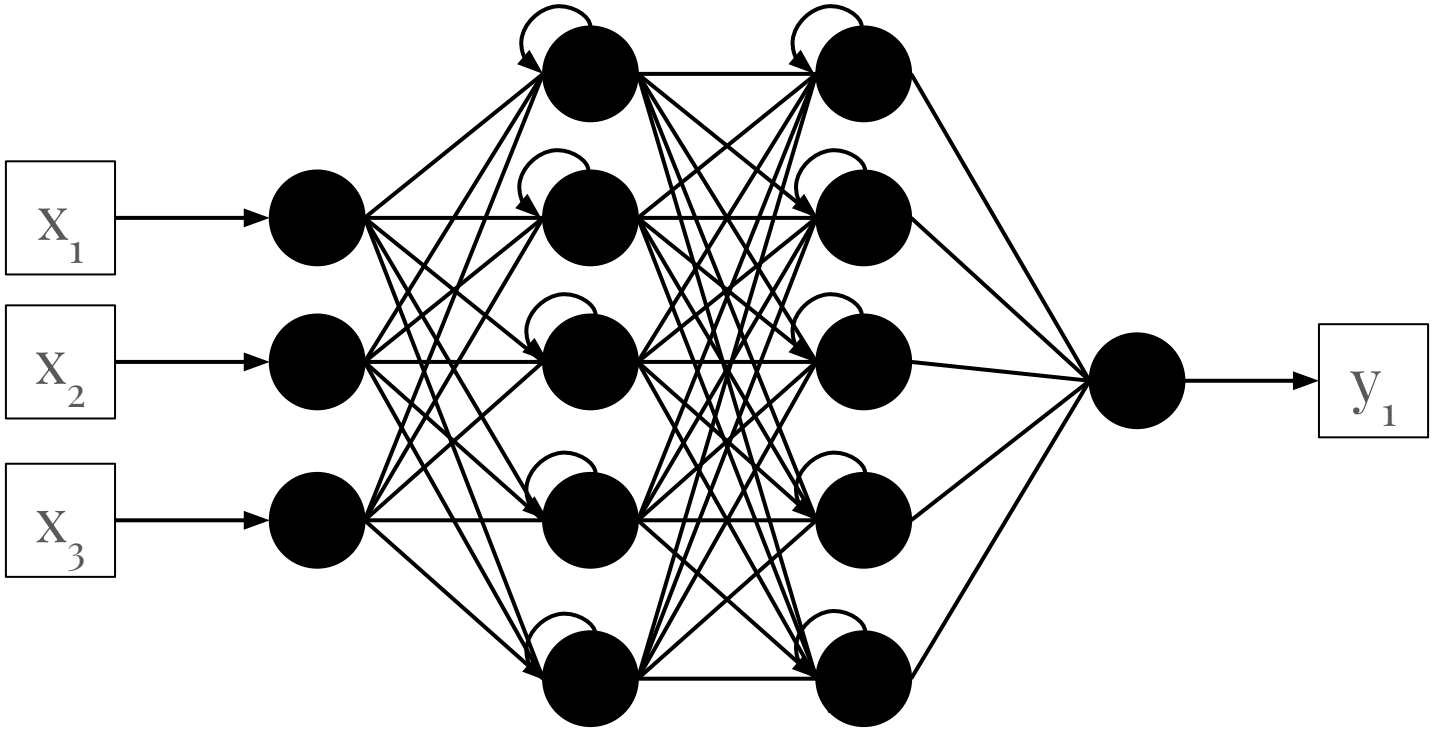
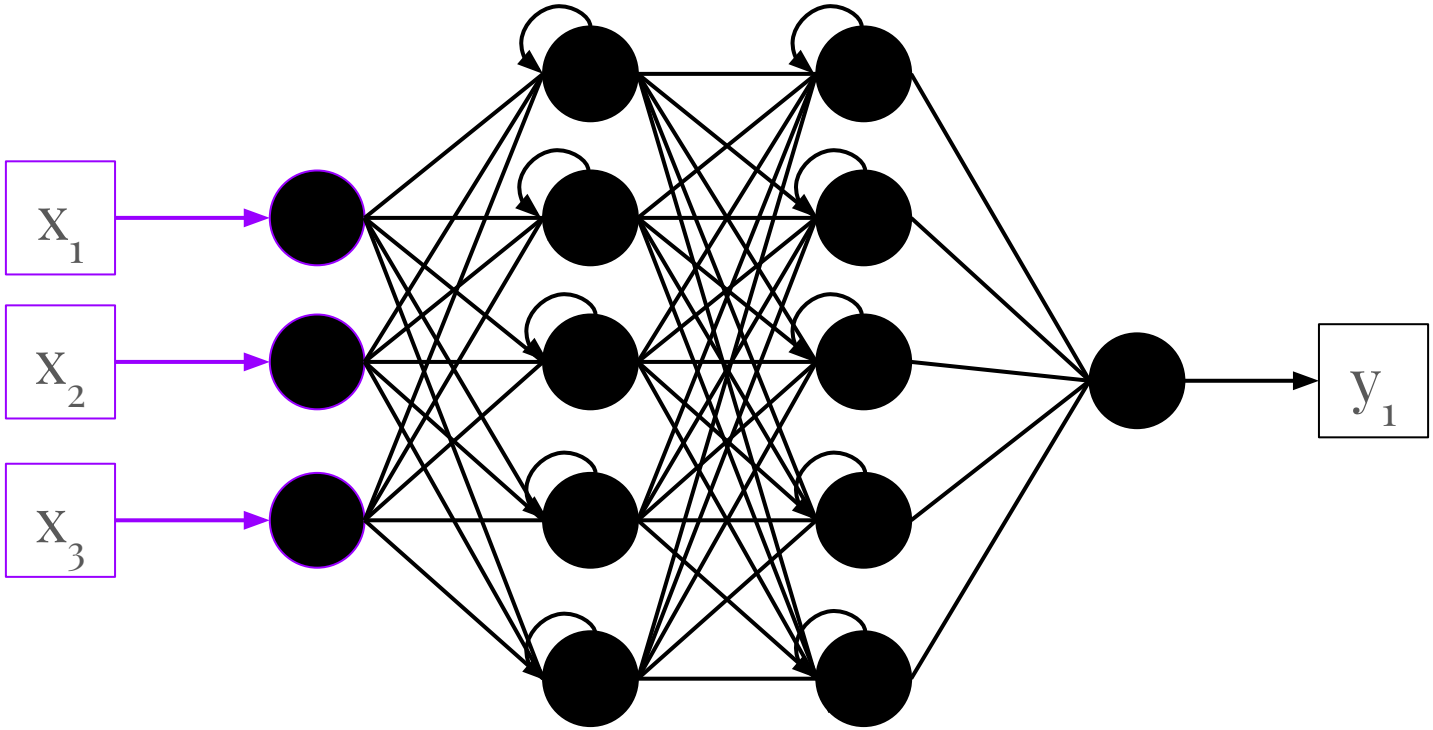


Feedforward Neural Network

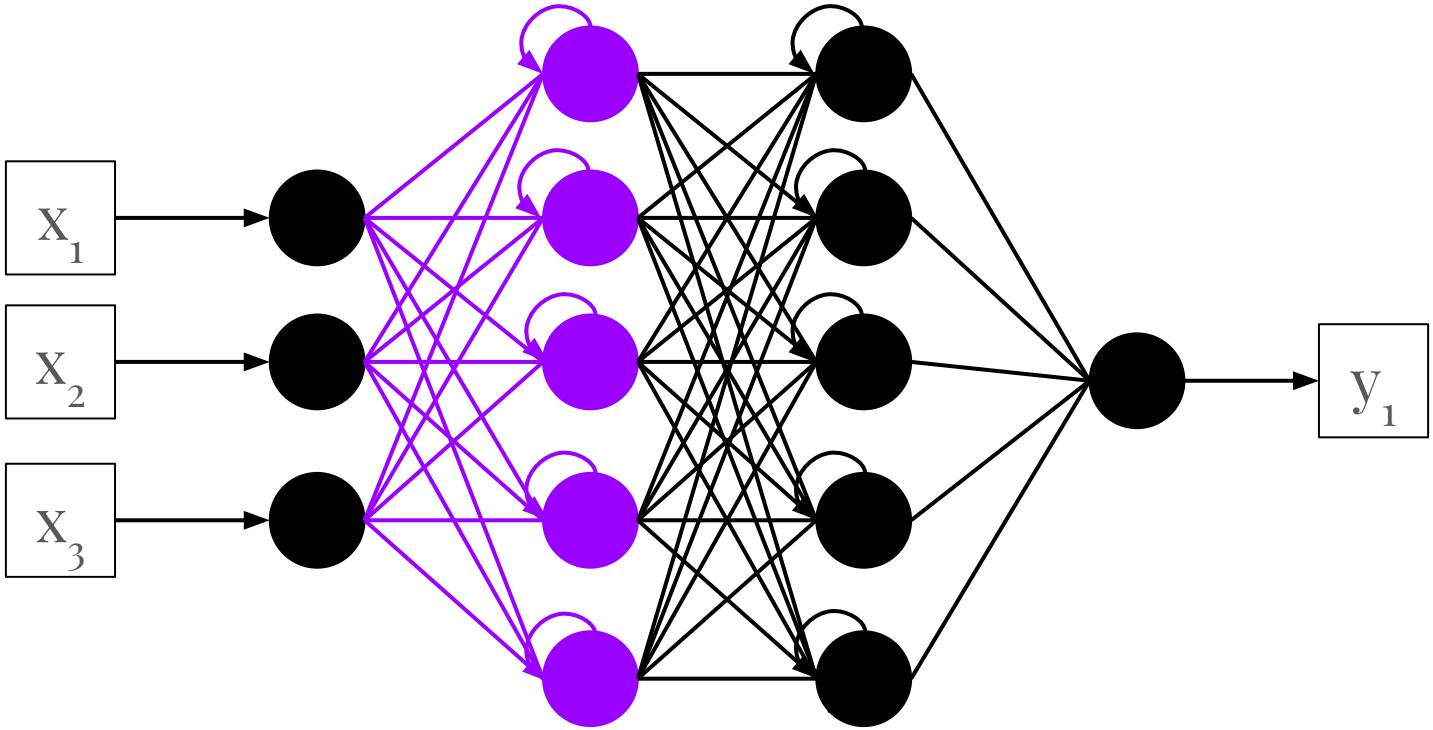
Recurrent Neural Networks



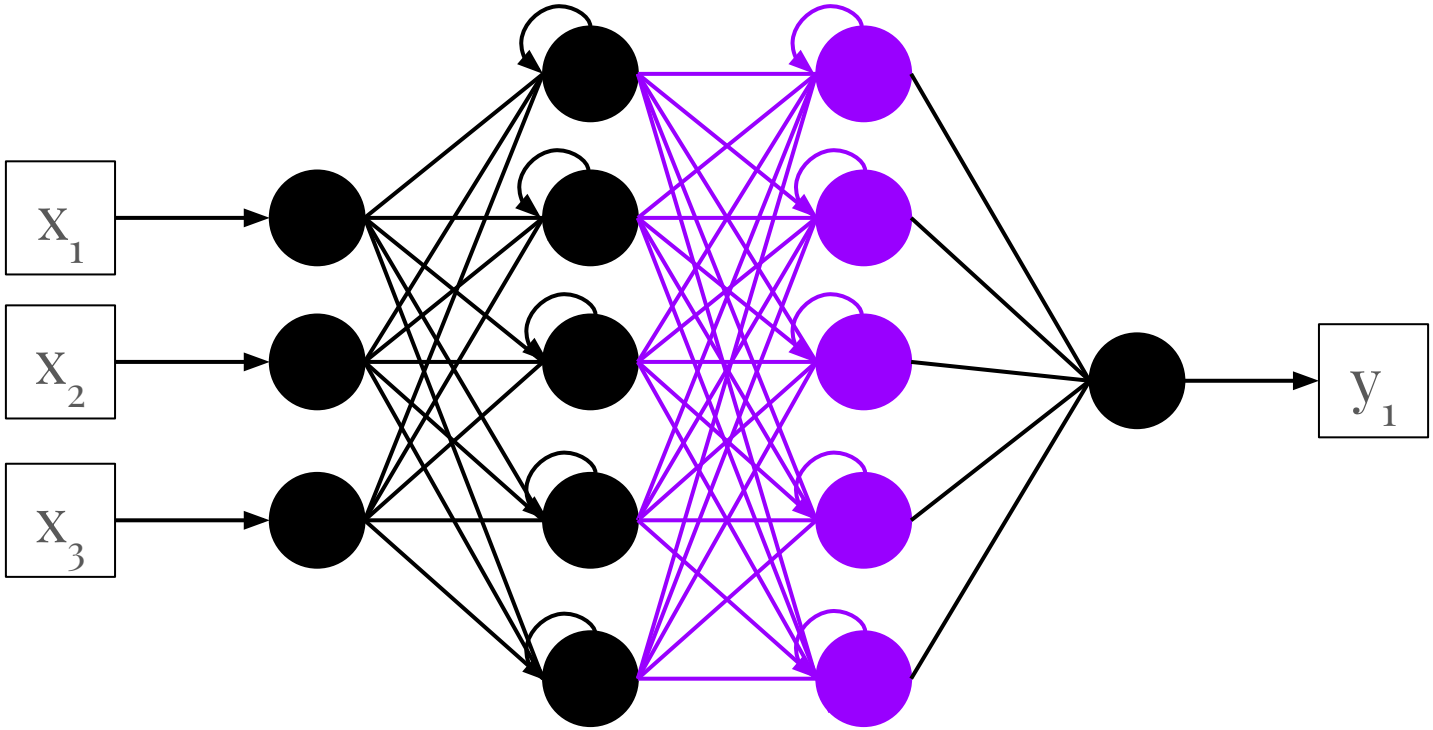
Simple Recurrent Neural Network



Simple Recurrent Neural Network



Simple Recurrent Neural Network



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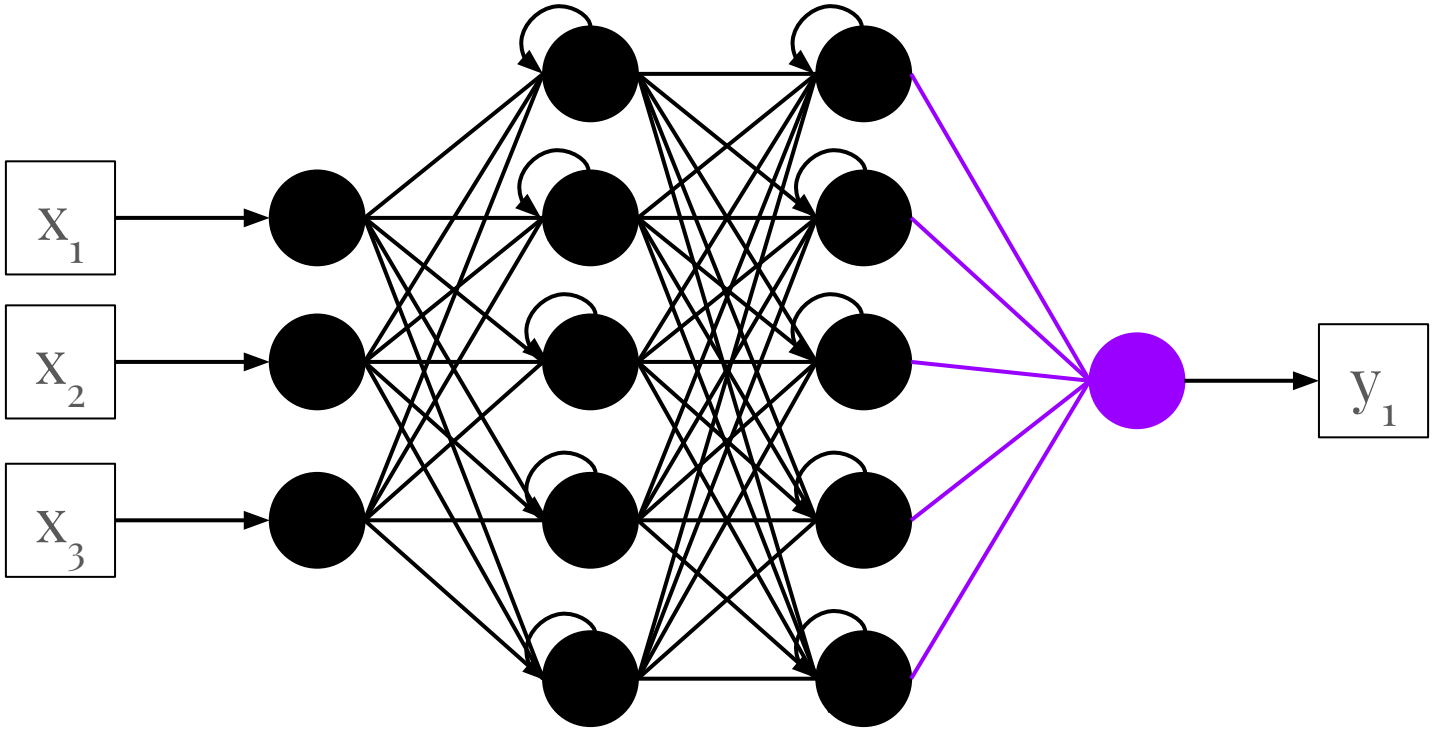

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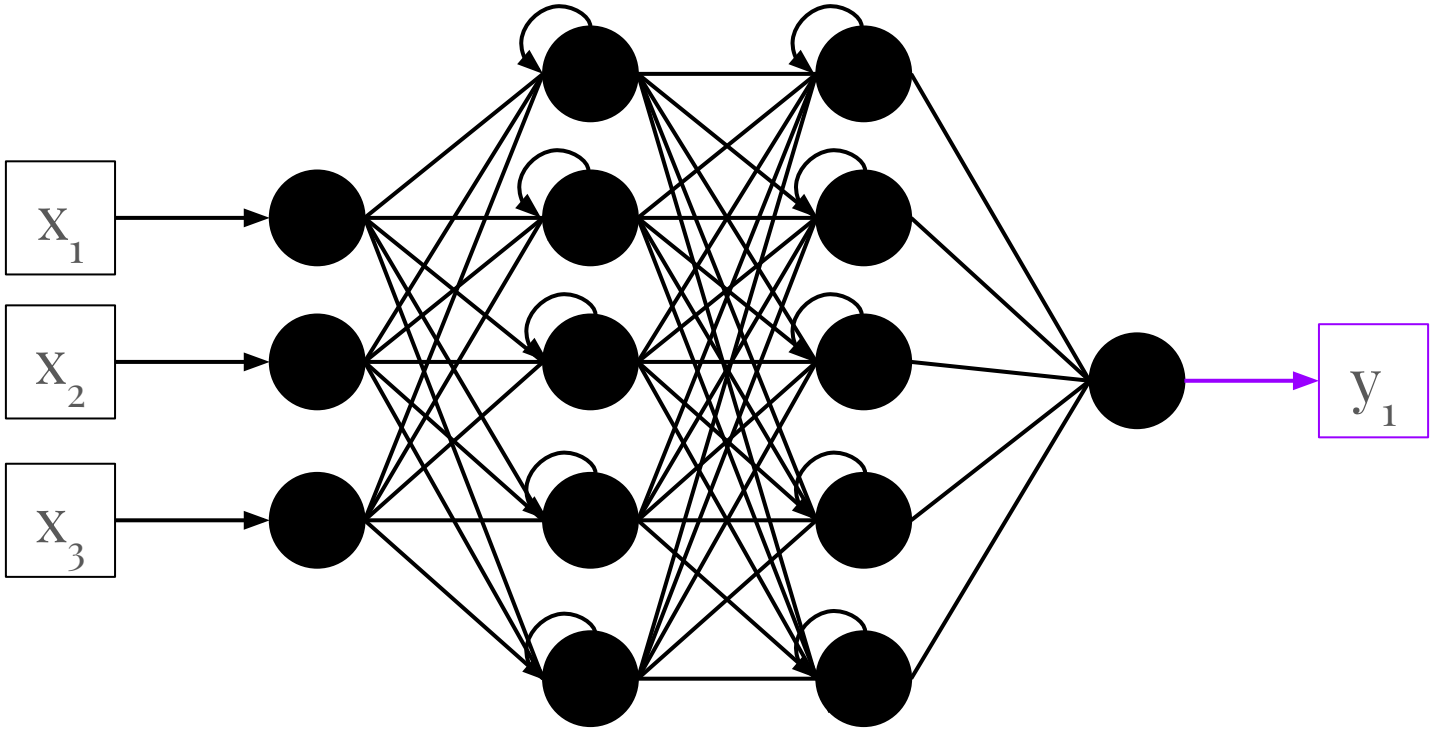

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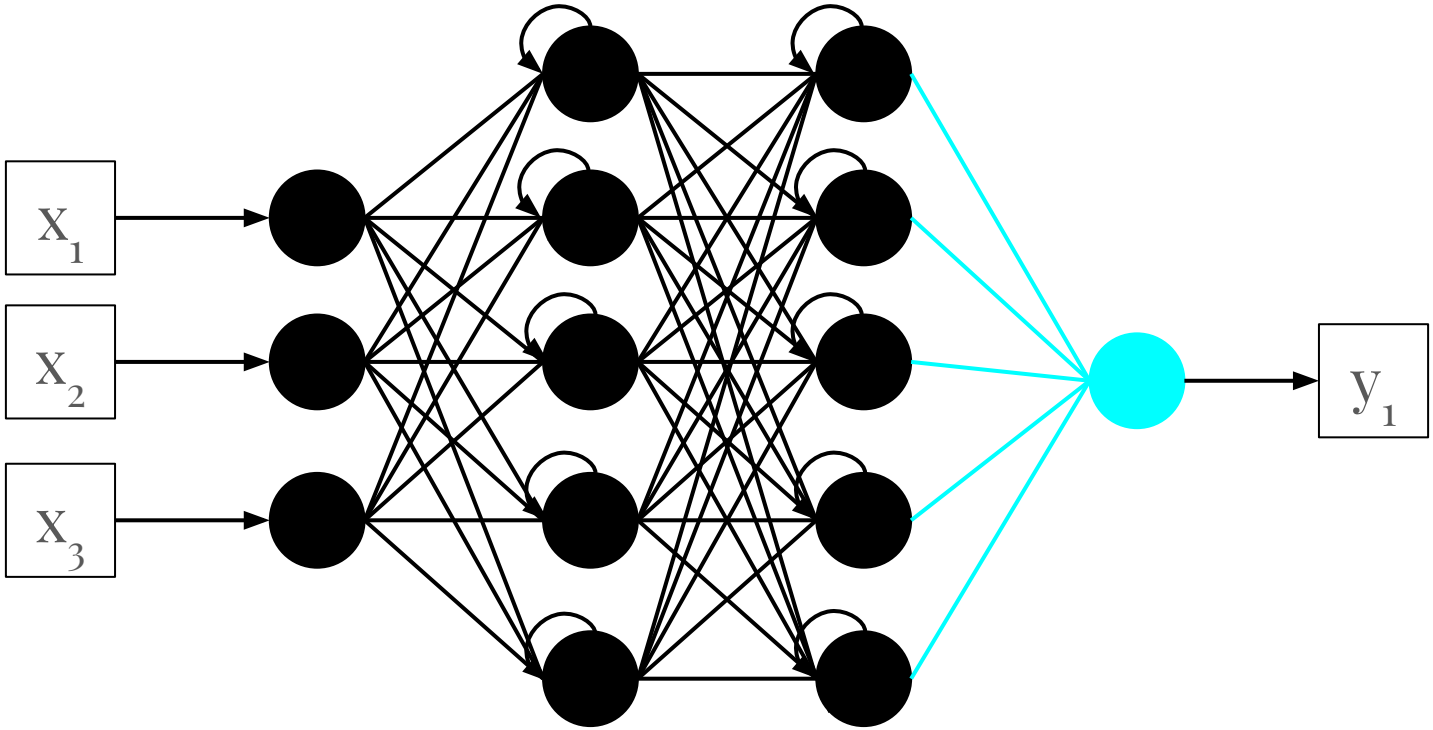

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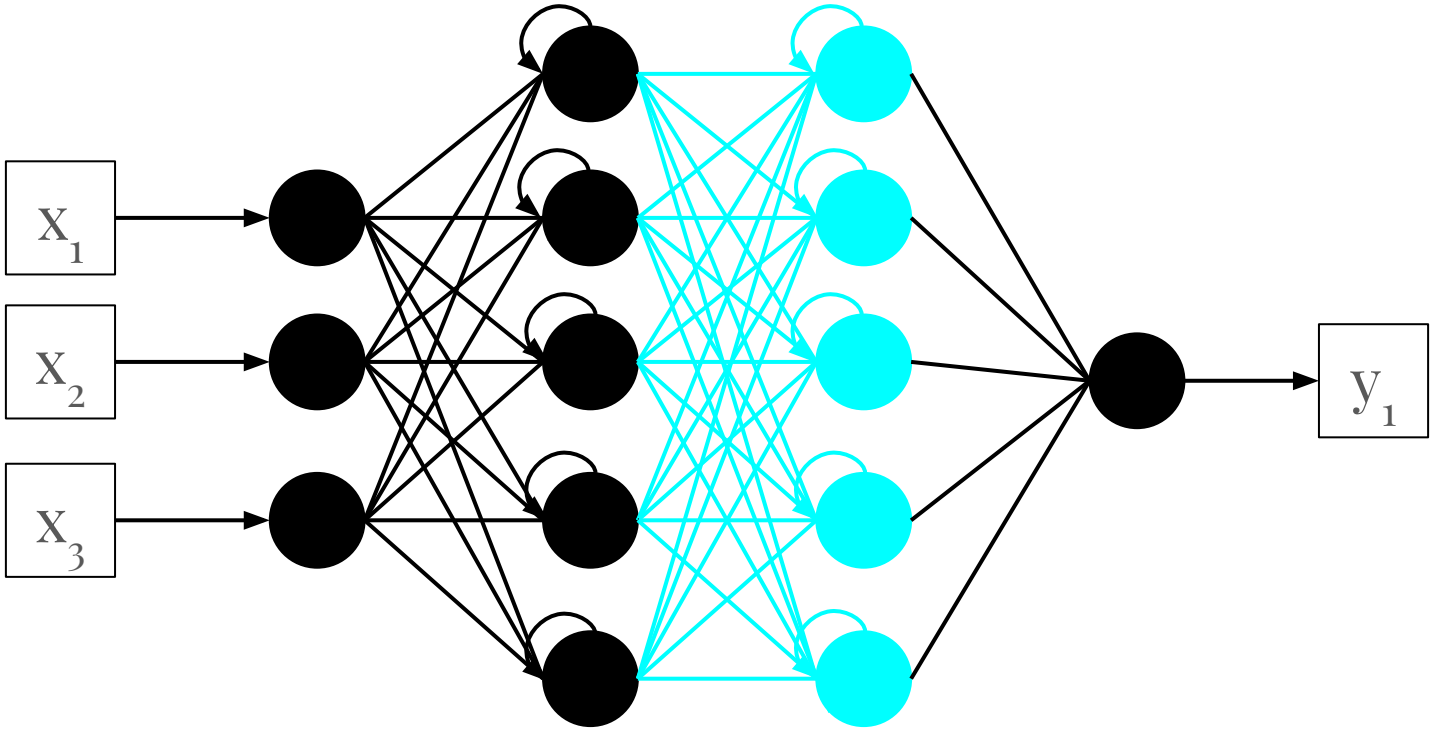

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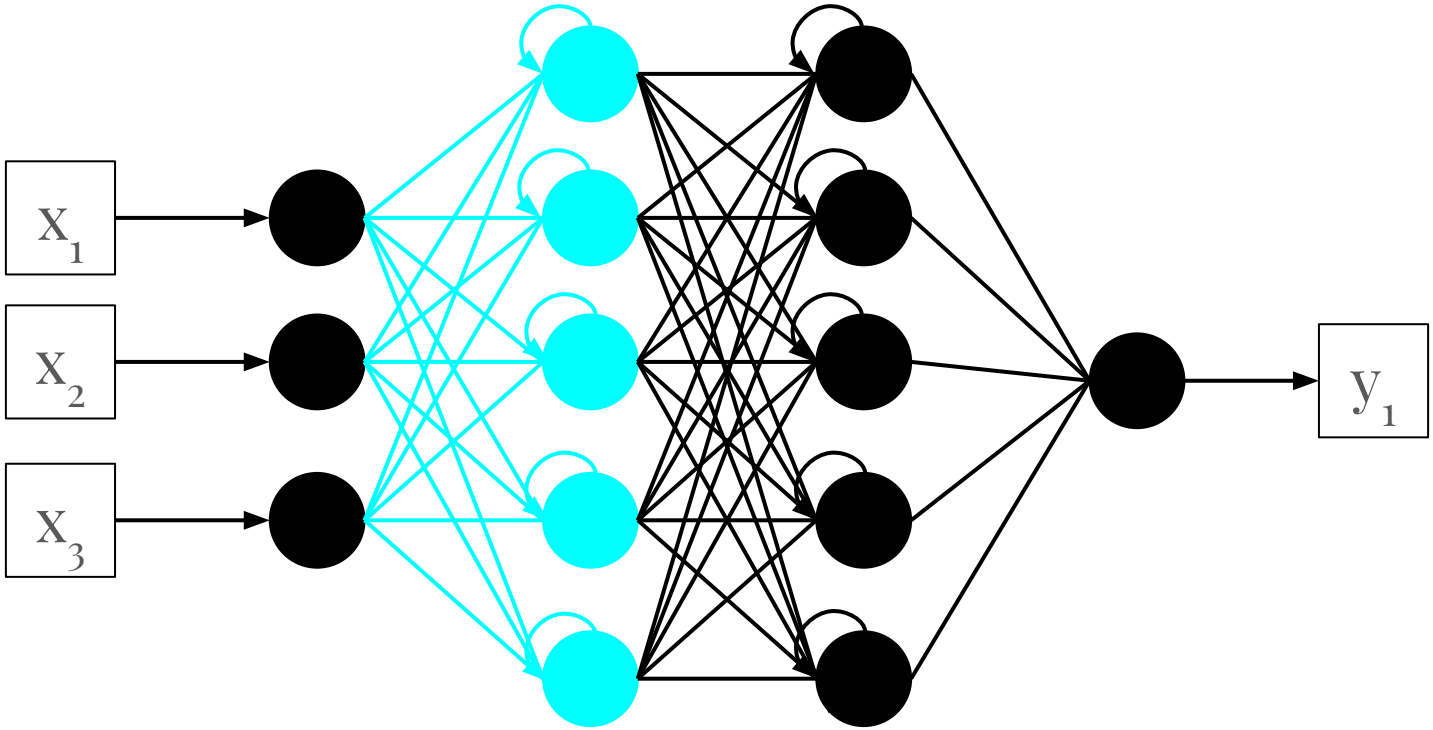

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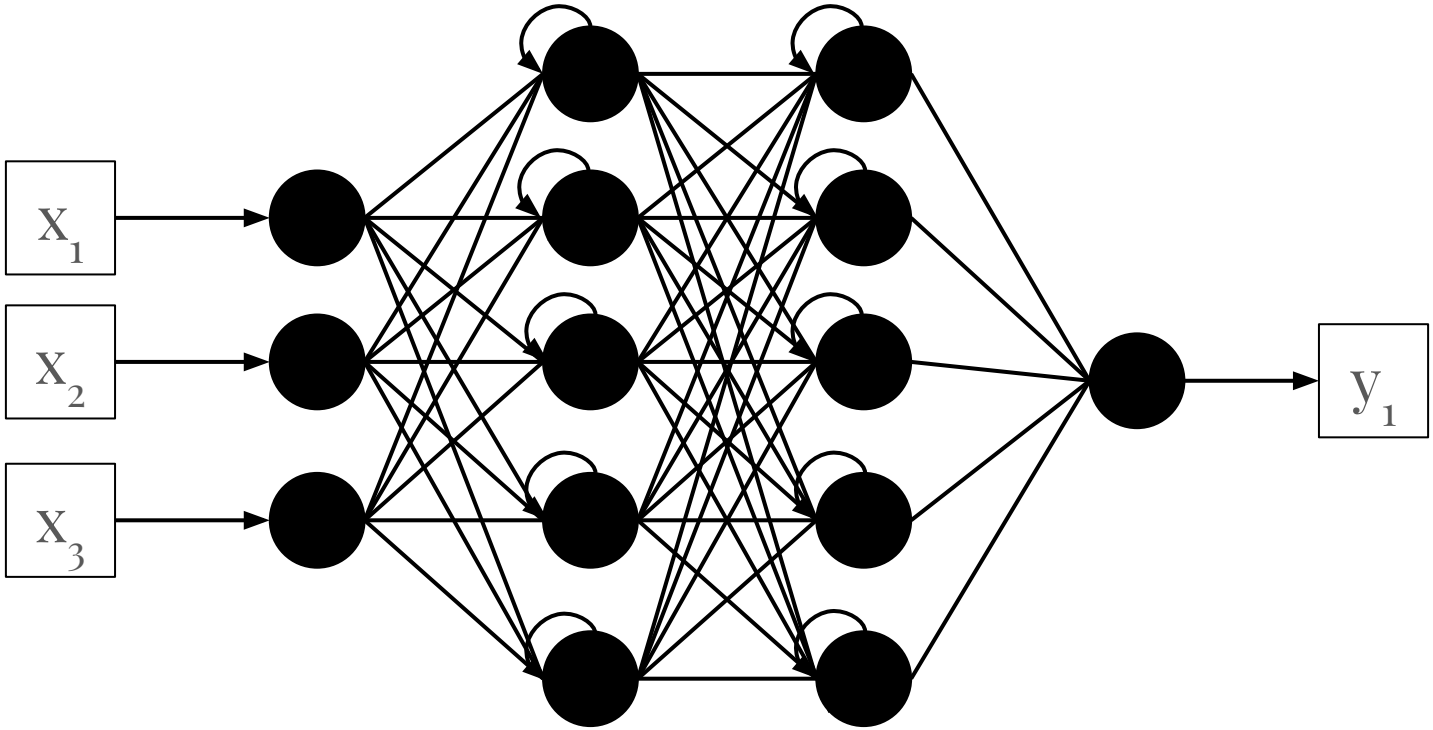
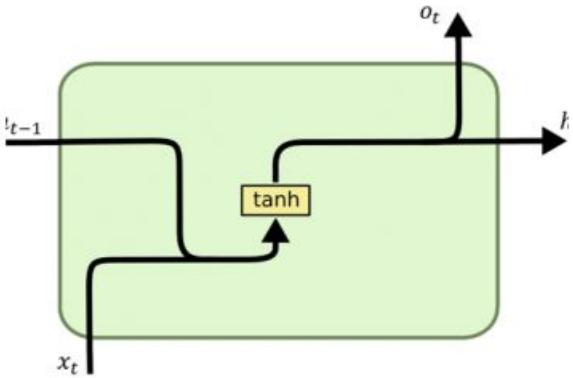
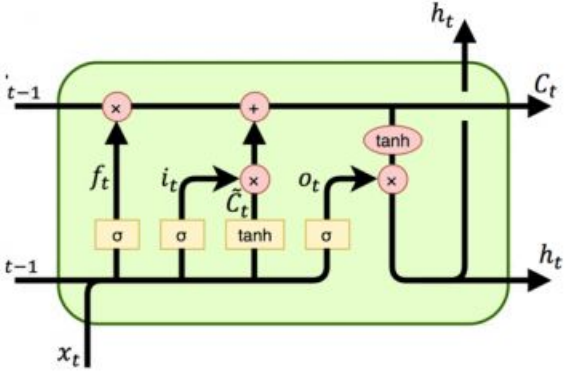


Simple Recurrent Neural Network

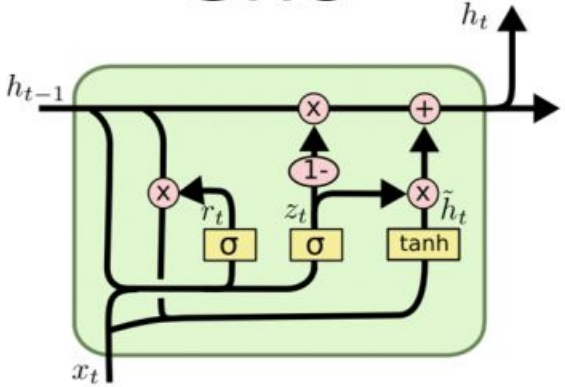
RNN



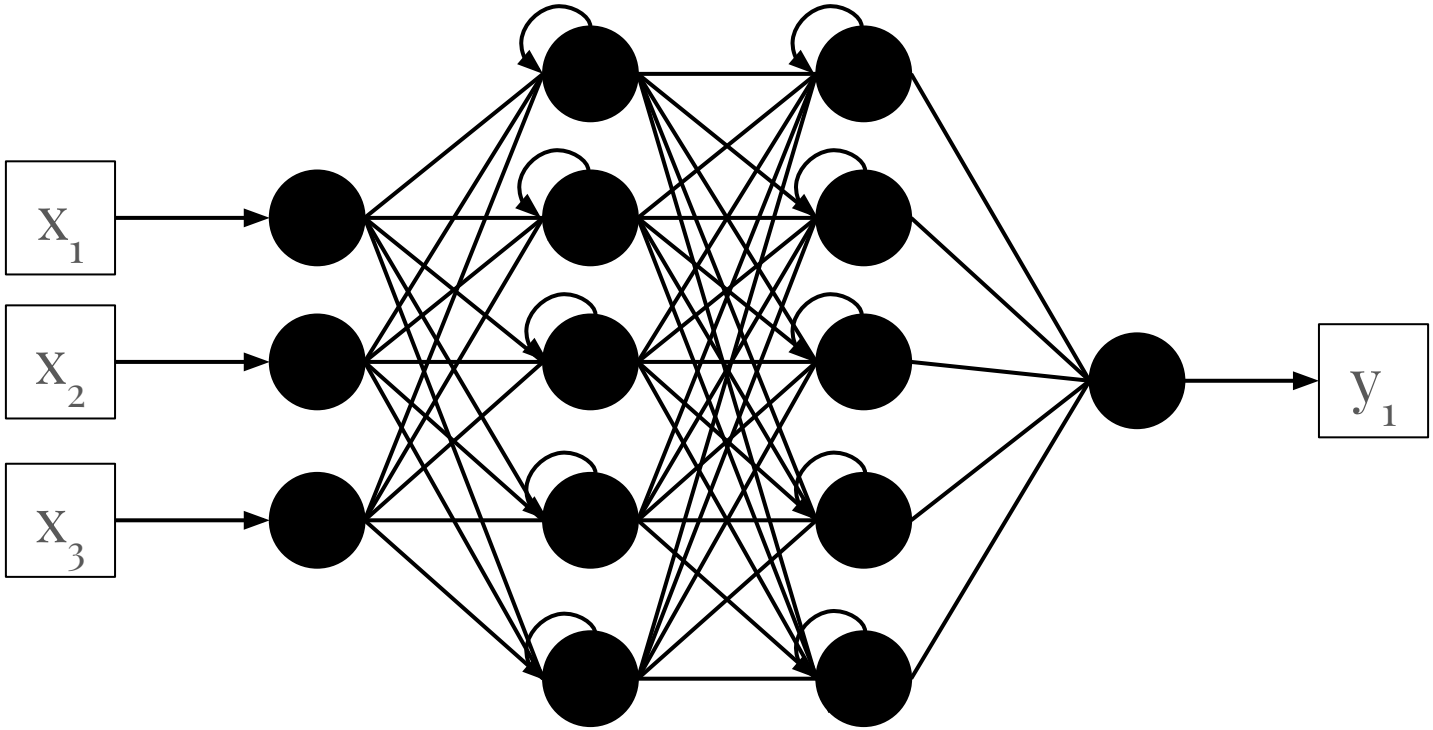
LSTM



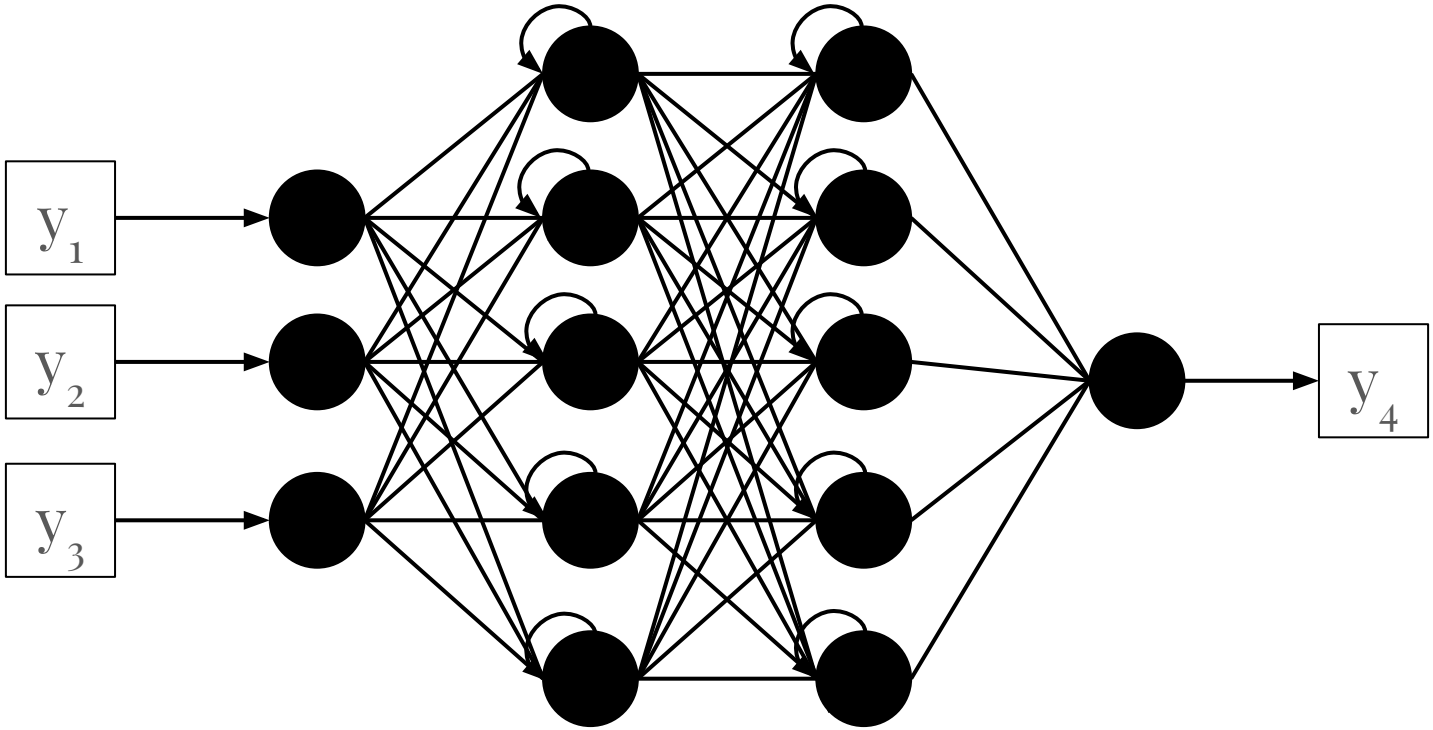
GRU



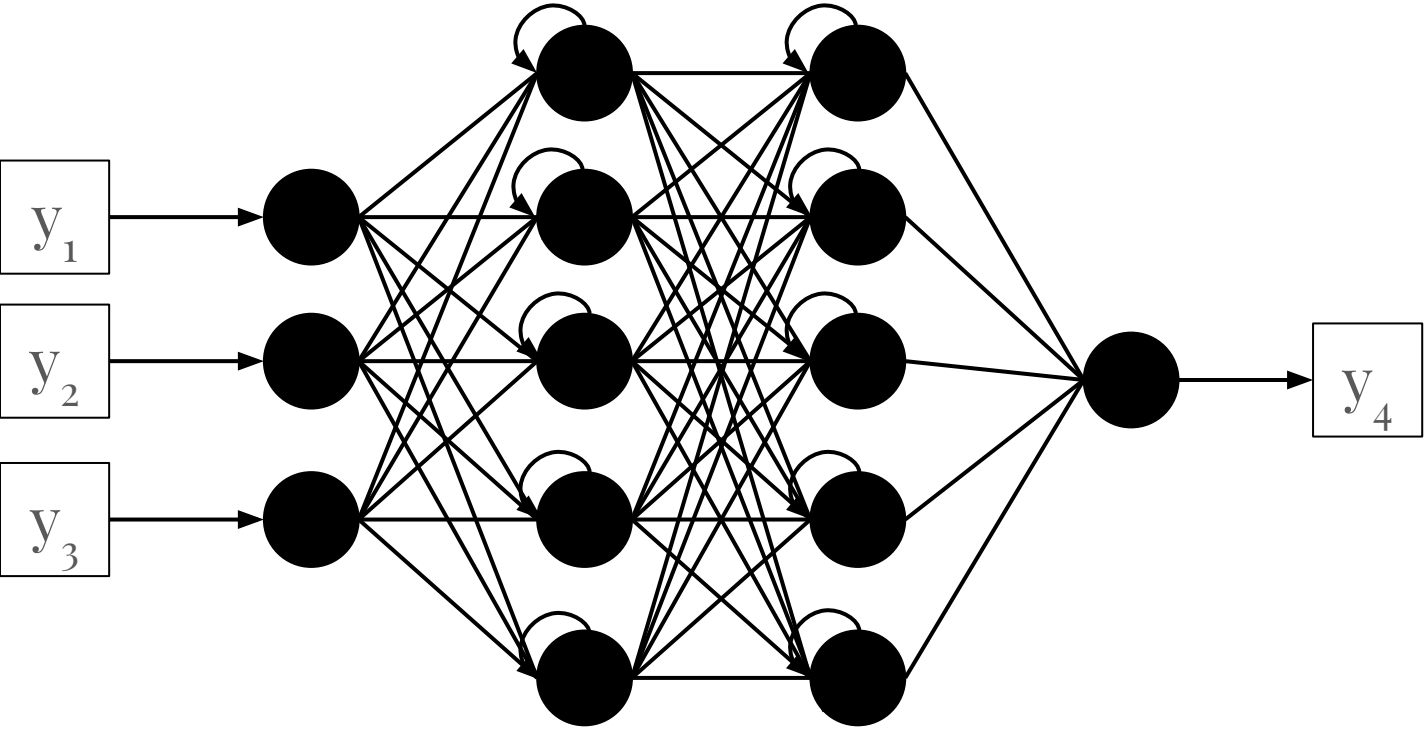
More Complicated Recurrent Neural Network Versions



Normal (Point-Wise Input)



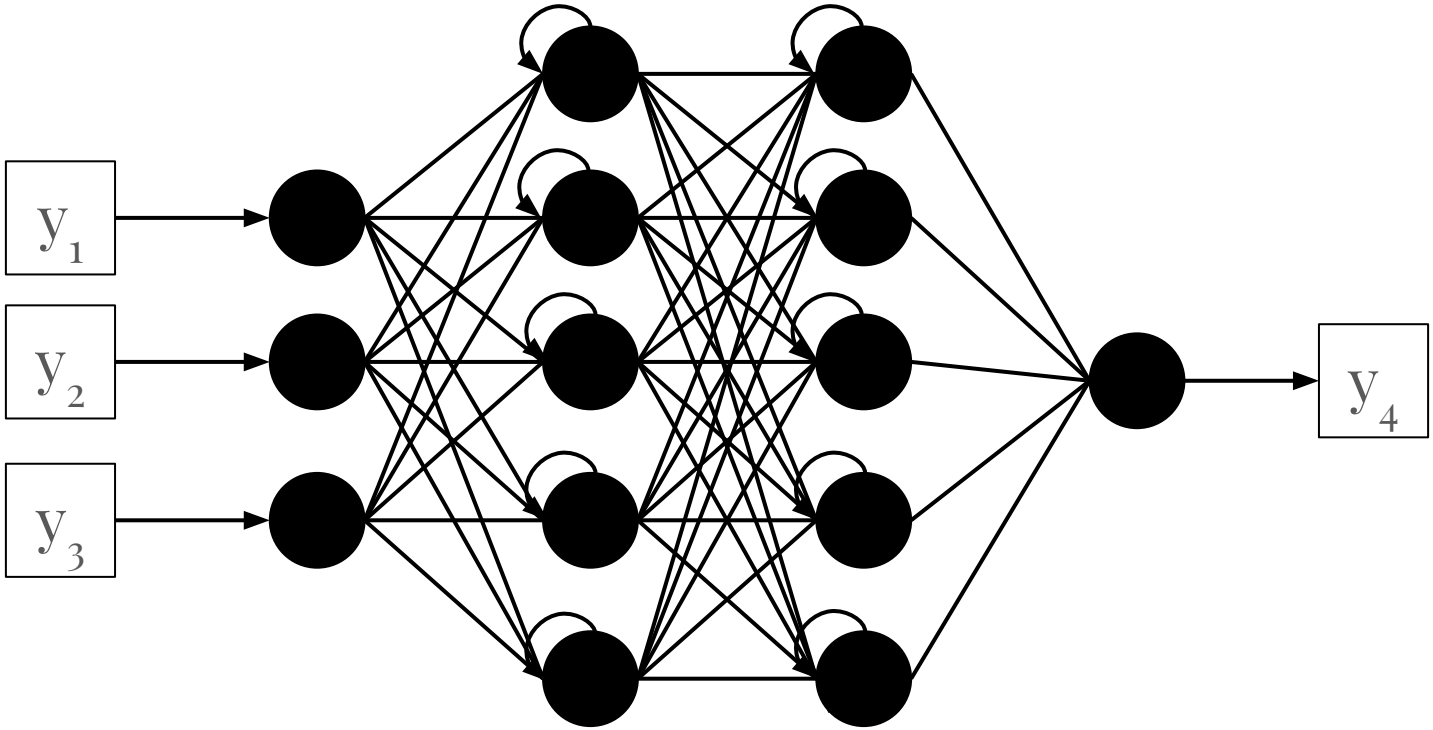
Time Series Formatting



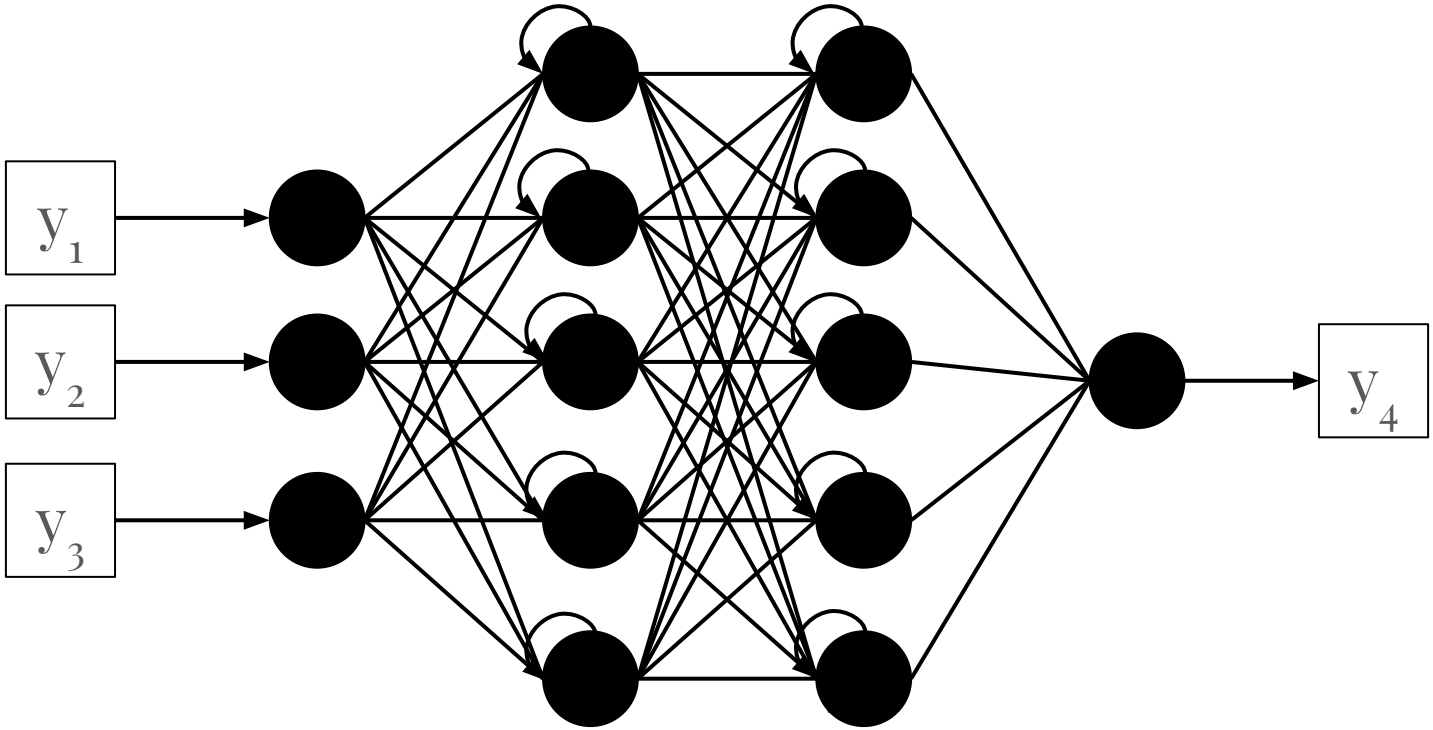
Text data can be considered time series (ordered) data

Time Series Formatting

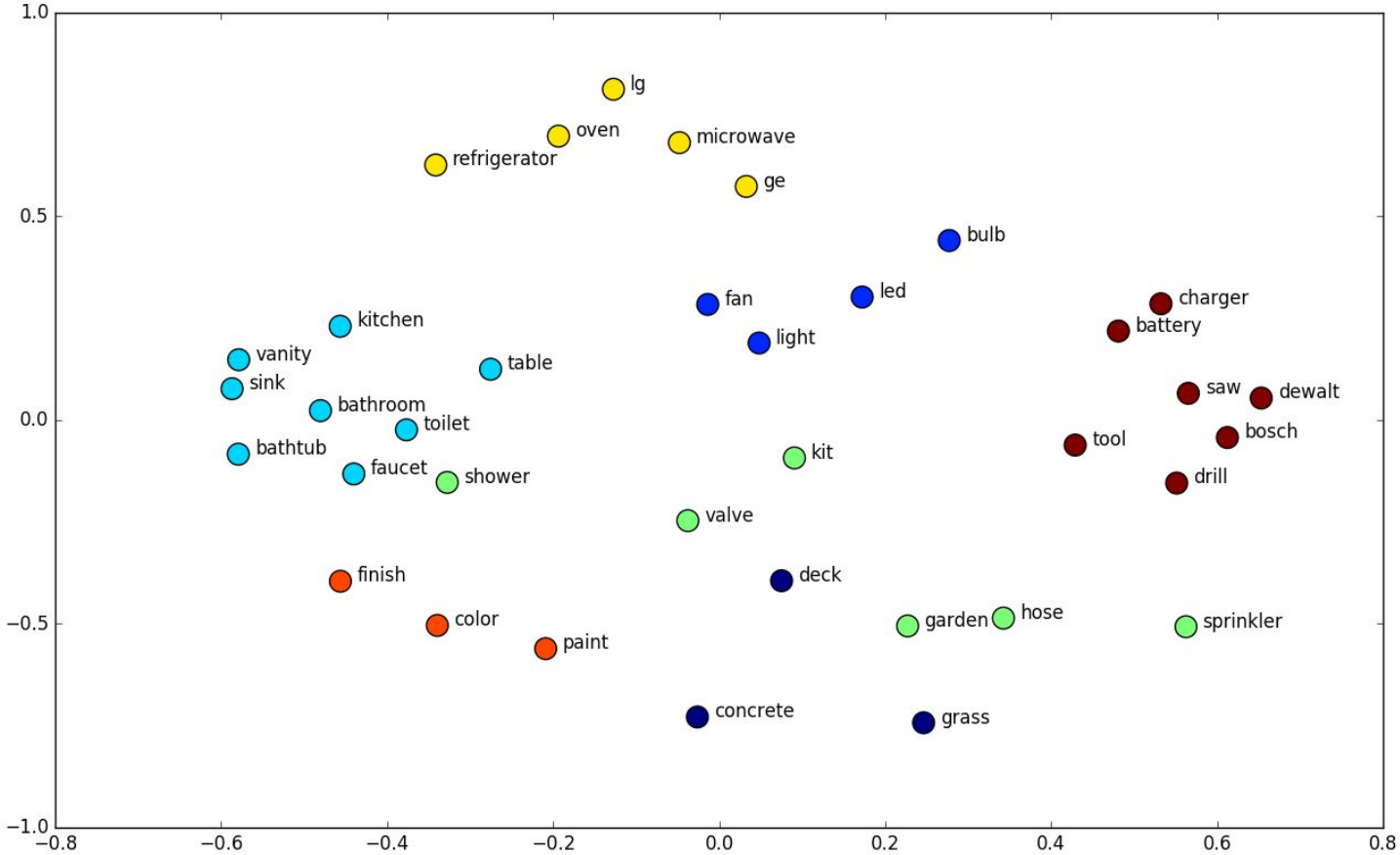
Working With Words



Numerical Data: (1,2,3) → 4



Word Data: (Mr., Worldwide, to) → Infinity



Word2Vec

Word Embedding

Predicting the Next Word In a Song

I don't want a lot for Christmas

There is just one thing I need

I don't care about the presents underneath the Christmas tree

I just want you for my own

More than you could ever know

Make my wish come true

All I want for Christmas is you

I don't want a lot for Christmas

There is just one thing I need

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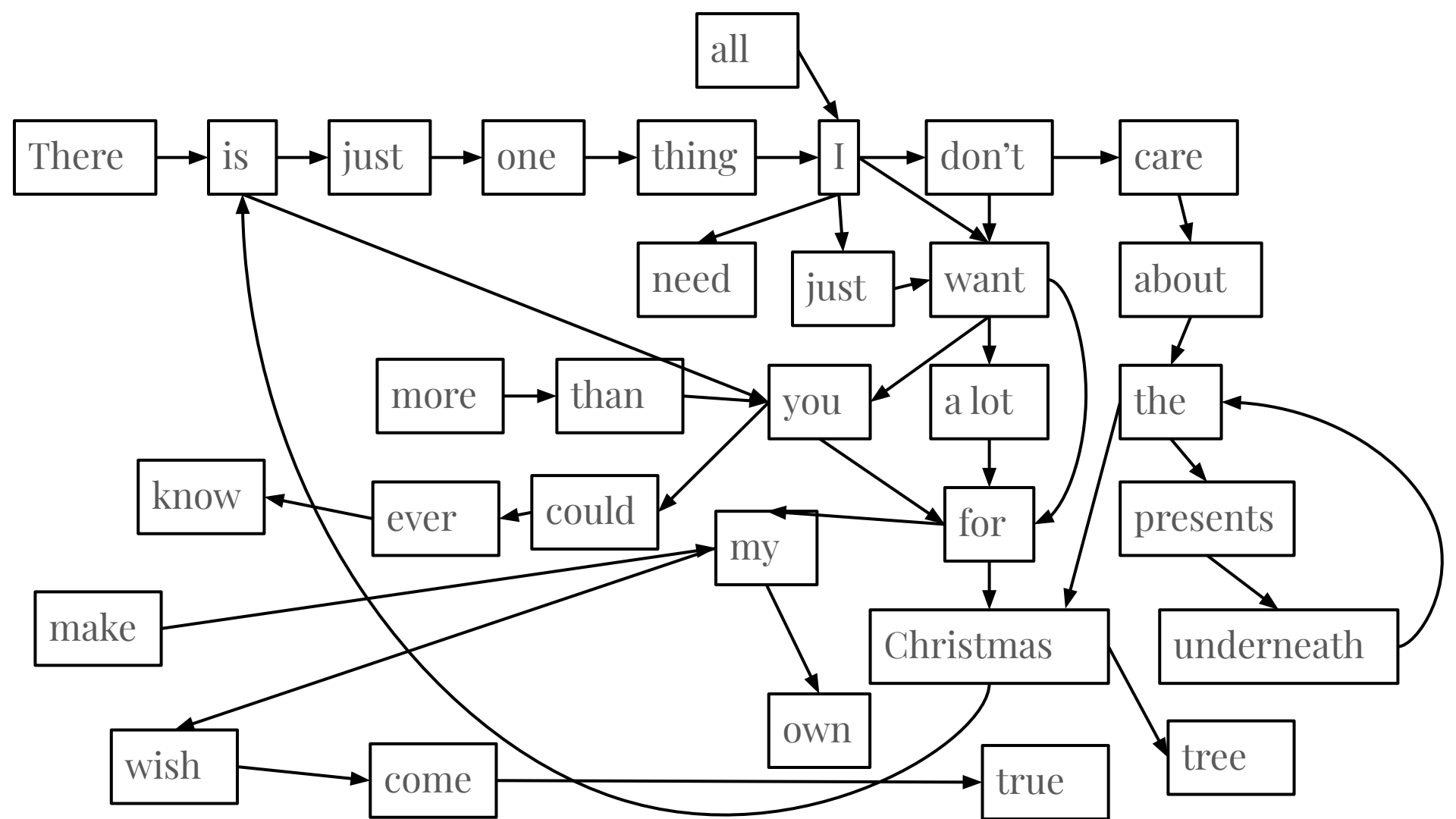
More than you could ever know

Make my wish come true

All I want for Christmas is you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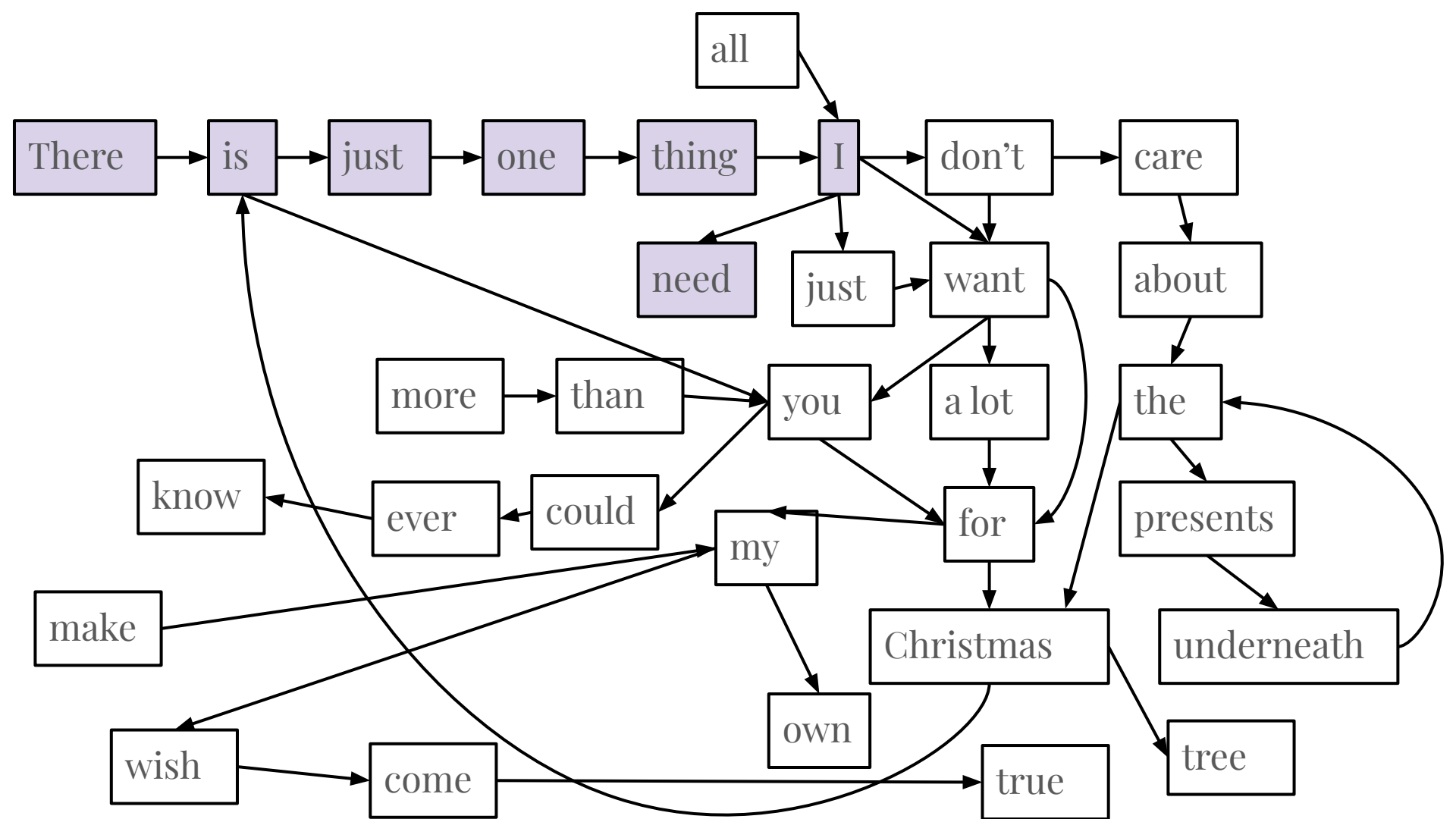
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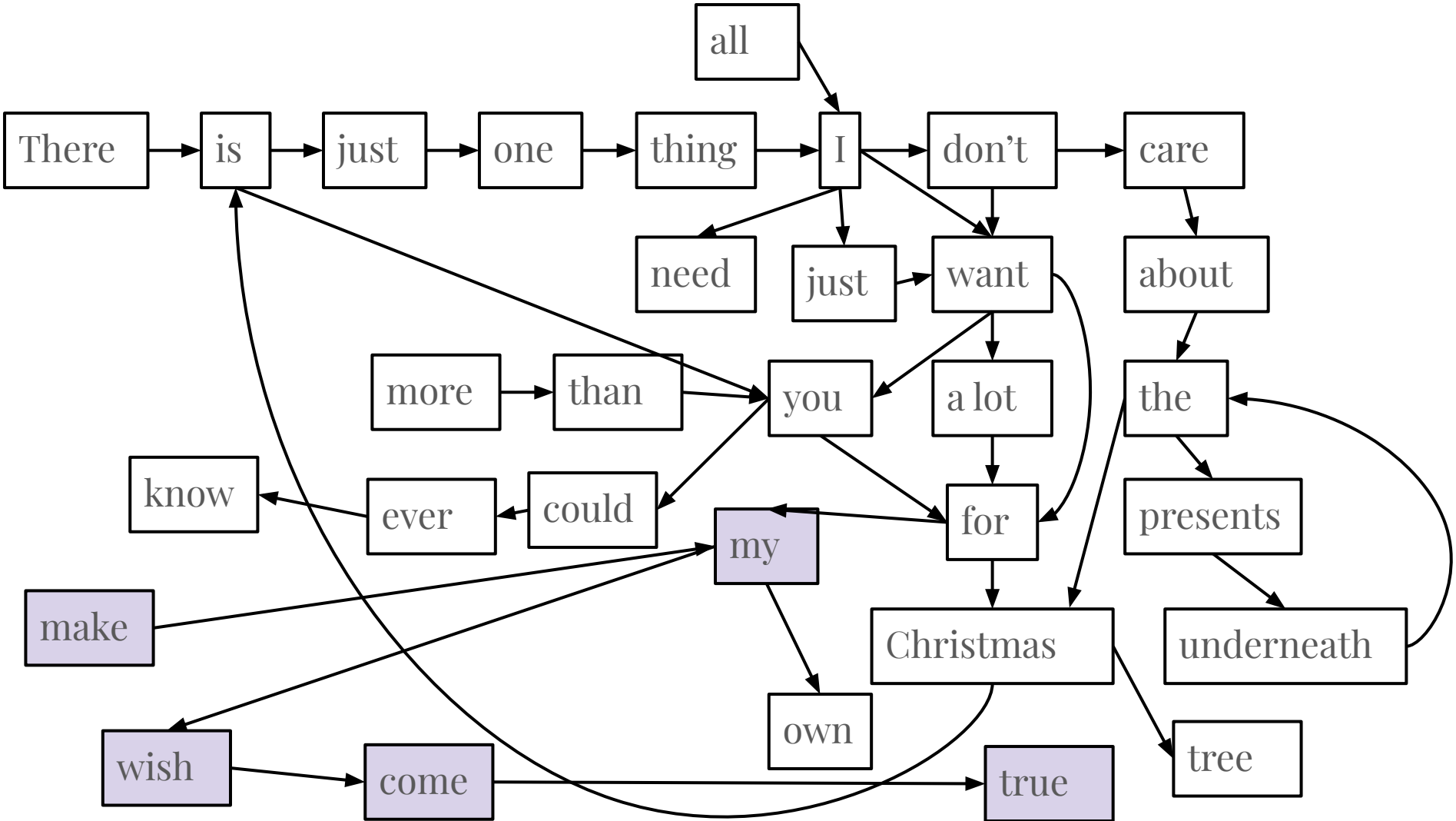
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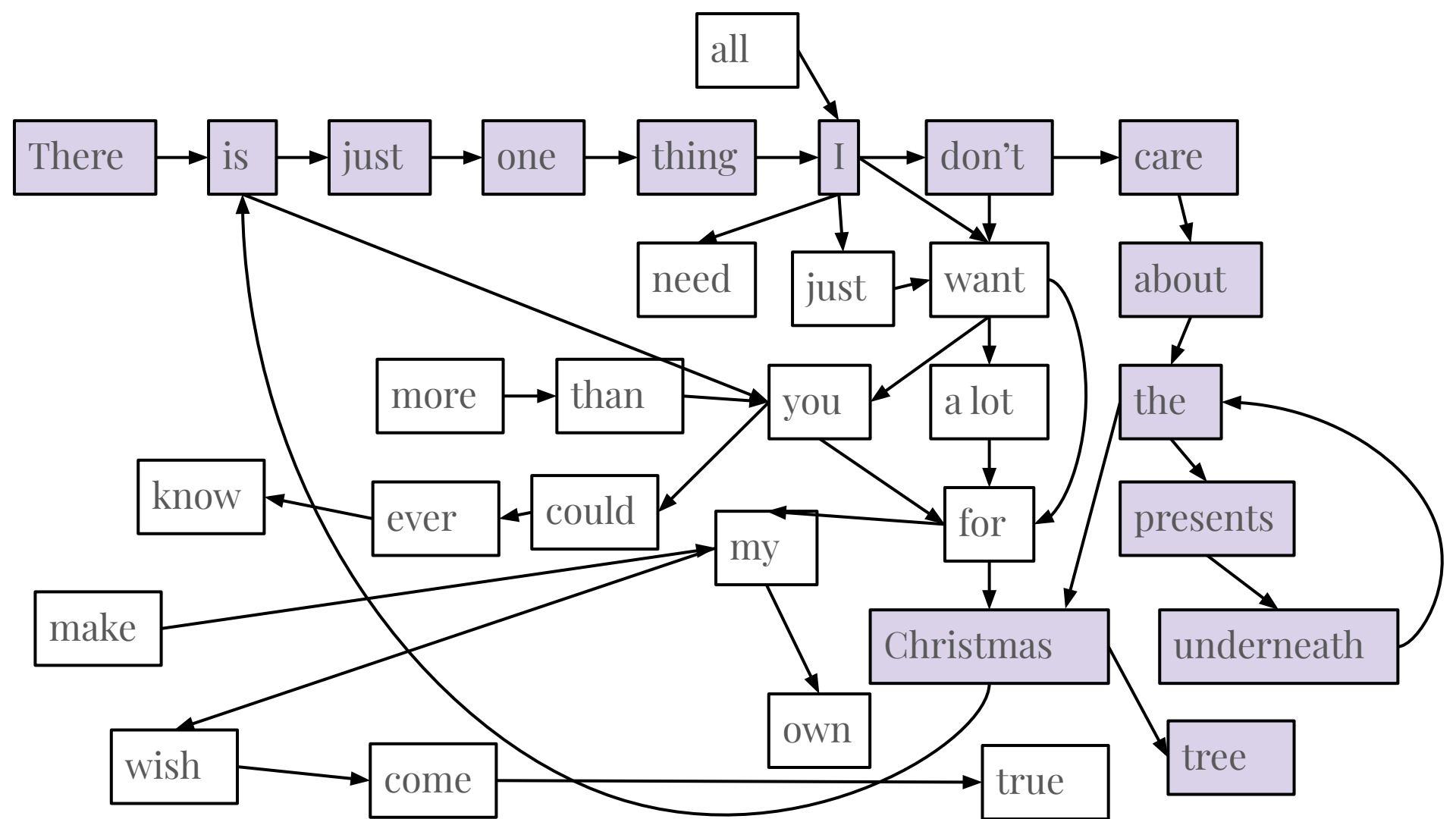
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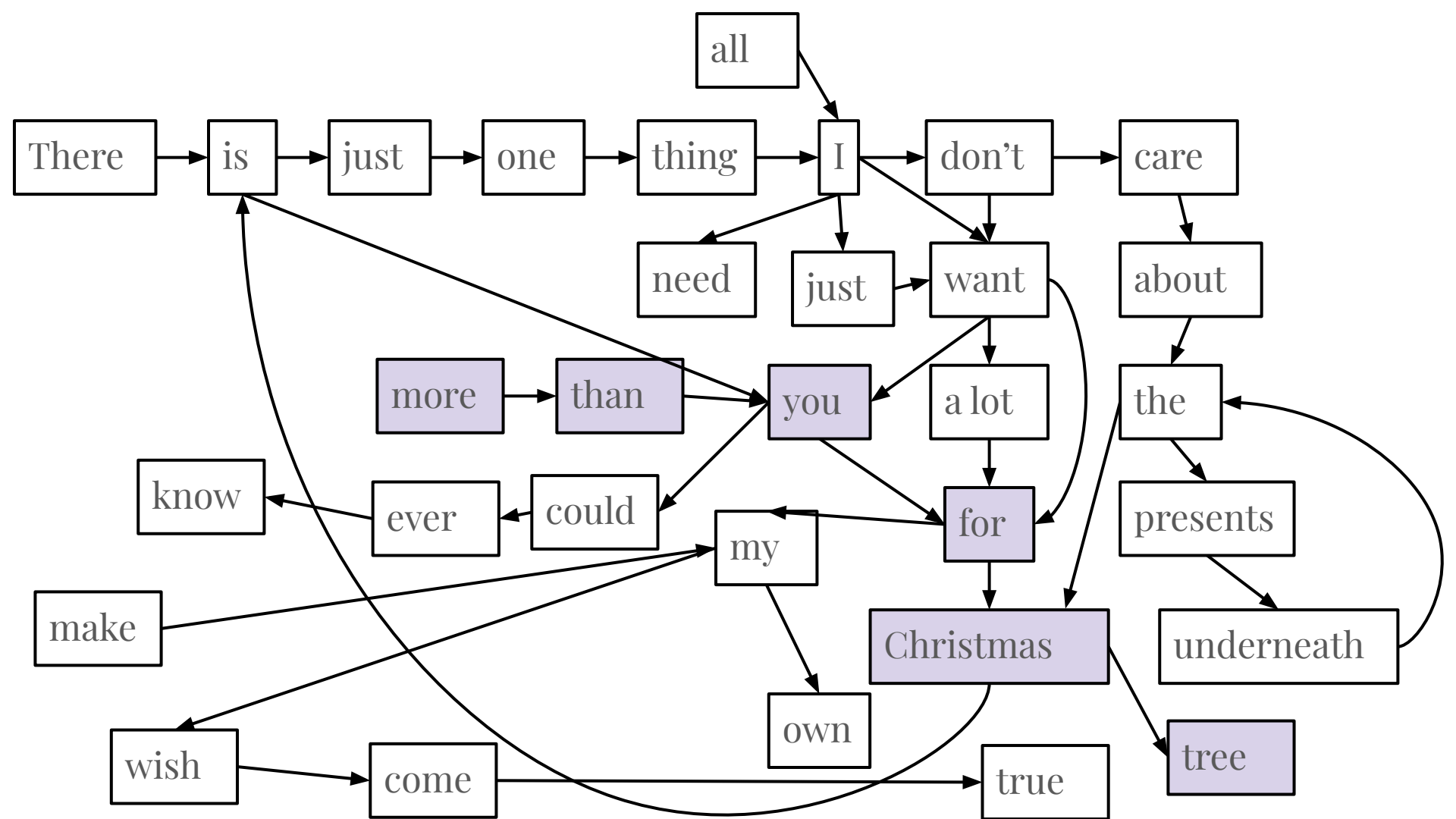
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I don't want a lot for Christmas

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Attention Networks

Attention Networks

- To properly interpret and produce intelligible sentences, you need to consider variable sequence lengths
  - Not something a normal neural network is capable of doing
- Solution: Attention networks!

Attention Is All You Need

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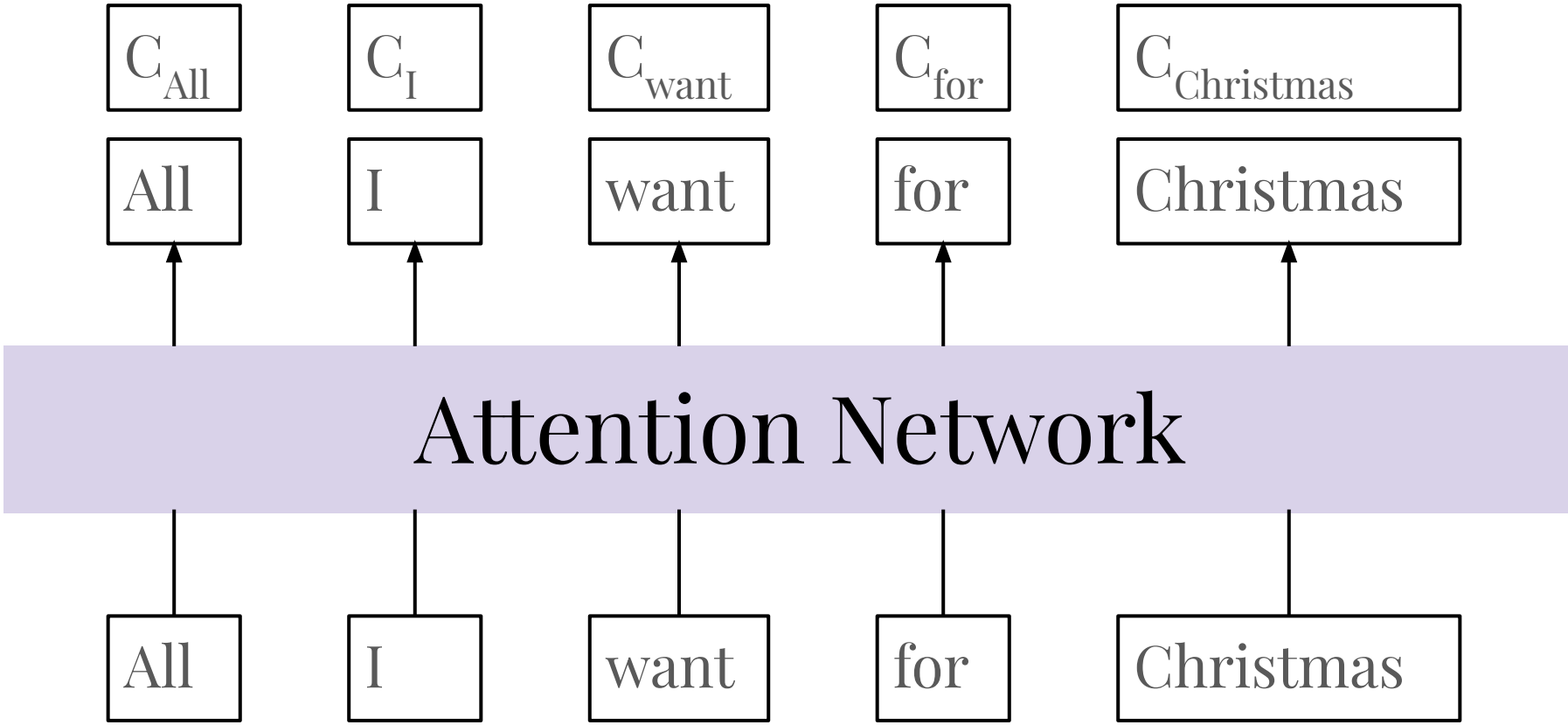
Aidan N. Gomez* † University of Toronto aidan@cs.toronto.edu

Łukasz Kaiser* Google Brain lukaszkaiser@google.com

Illia Polosukhin* ‡ illia.polosukhin@gmail.com


C_{All}
C_{I}
C_{want}
C_{for}
$C_{Christmas}$
All
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Christmas
Attention Network
All
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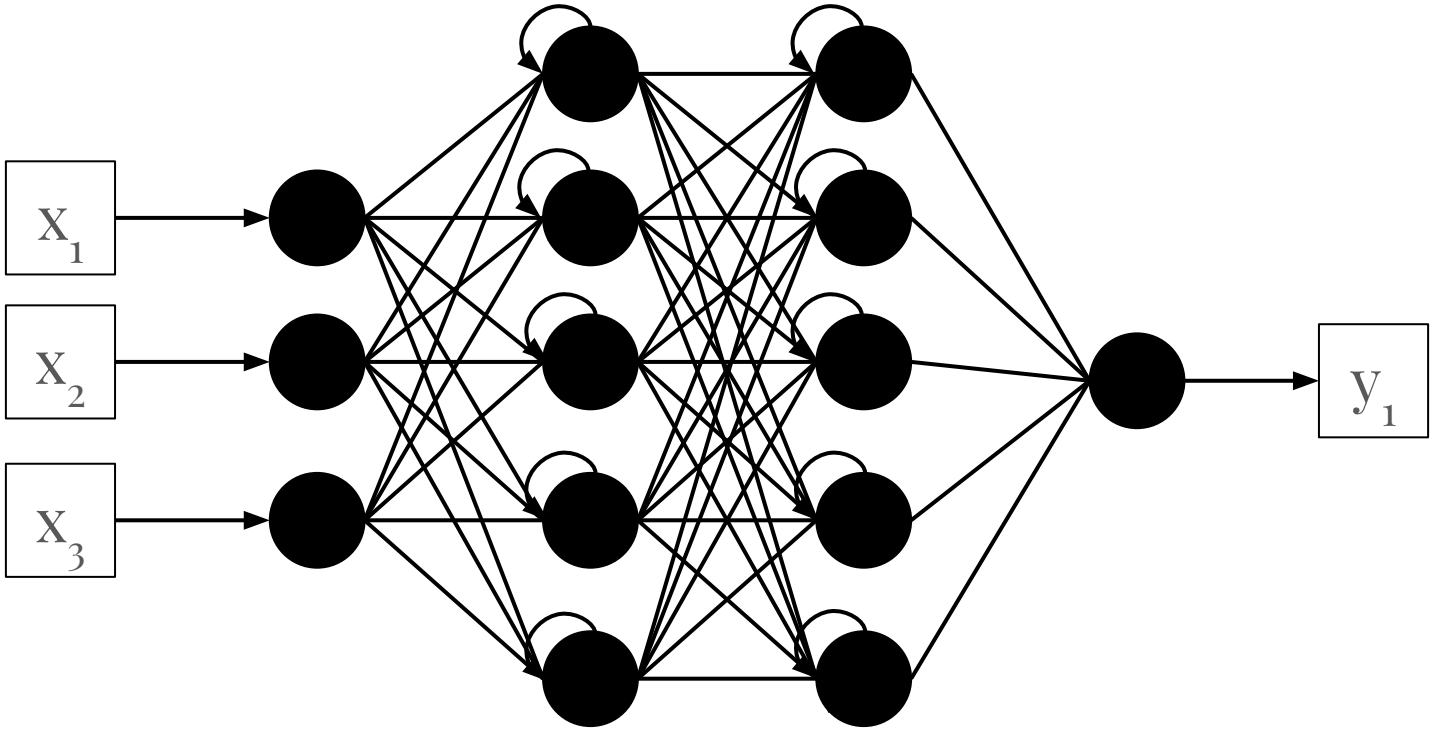
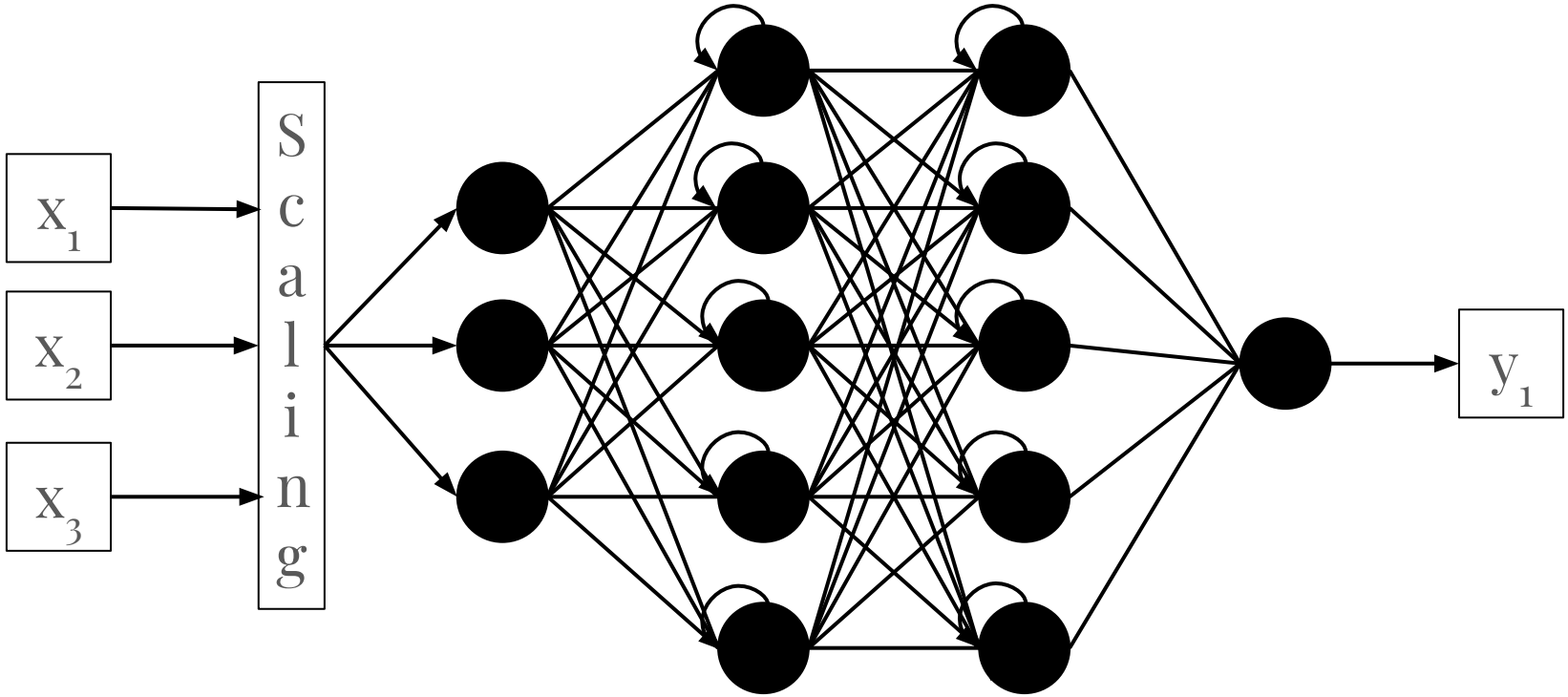
want
for
Christmas

Transformer Networks

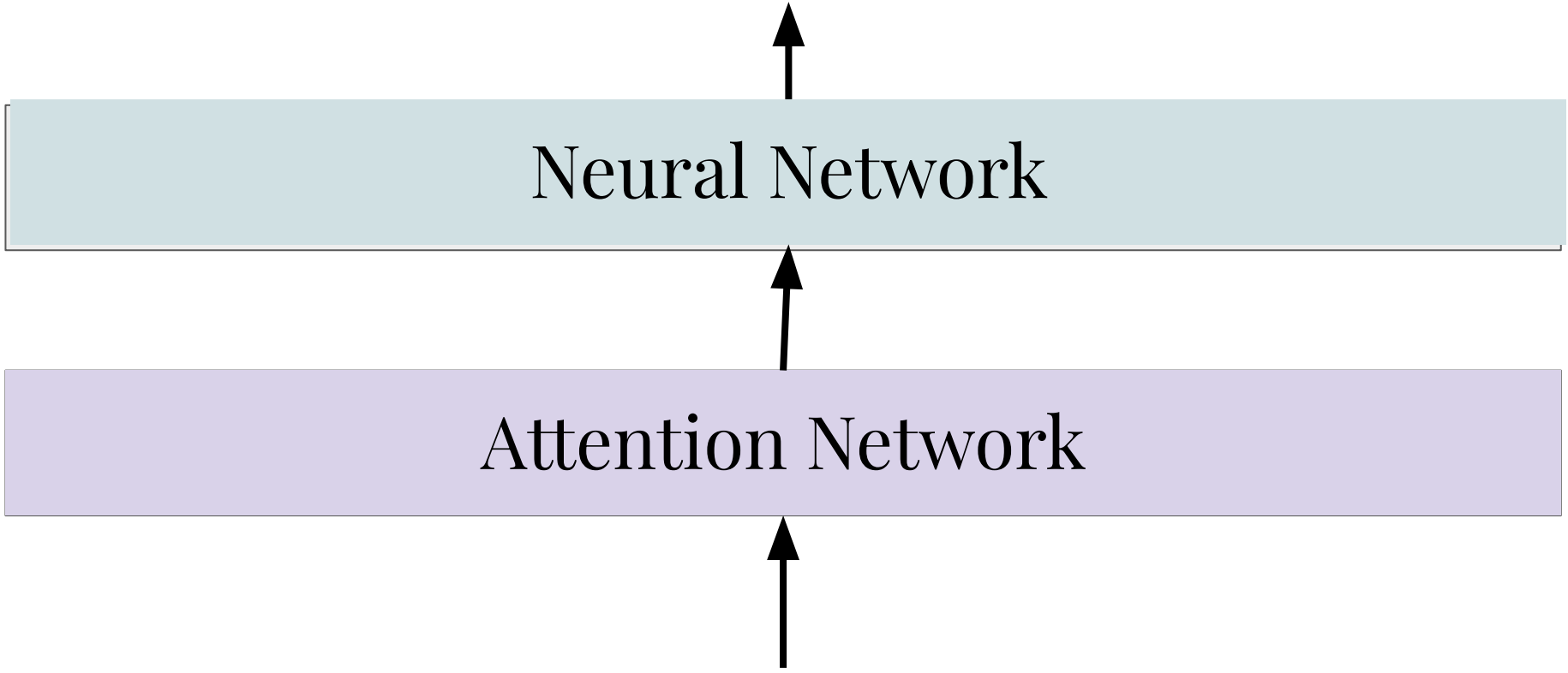


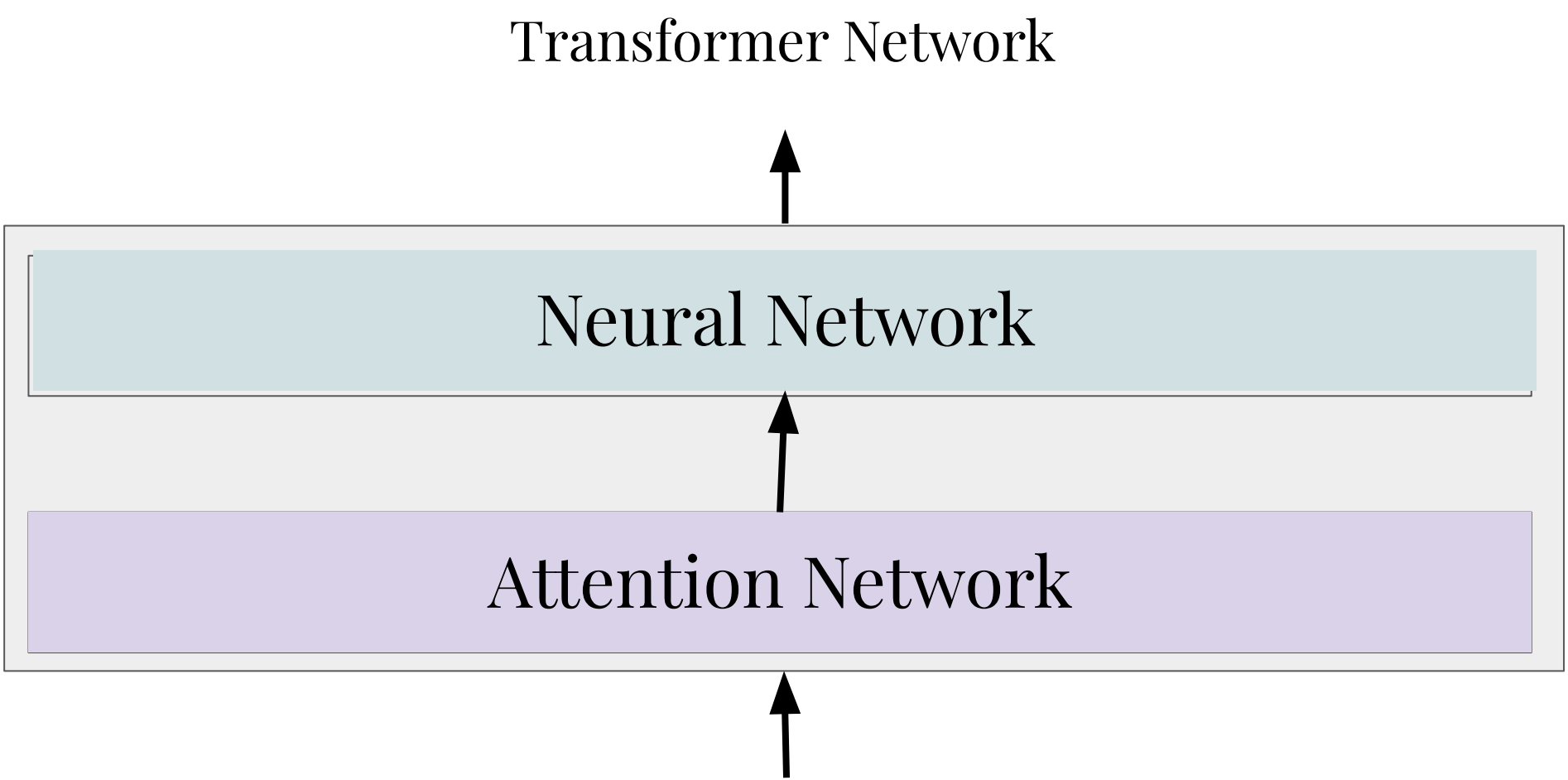
Simple Recurrent Neural Network



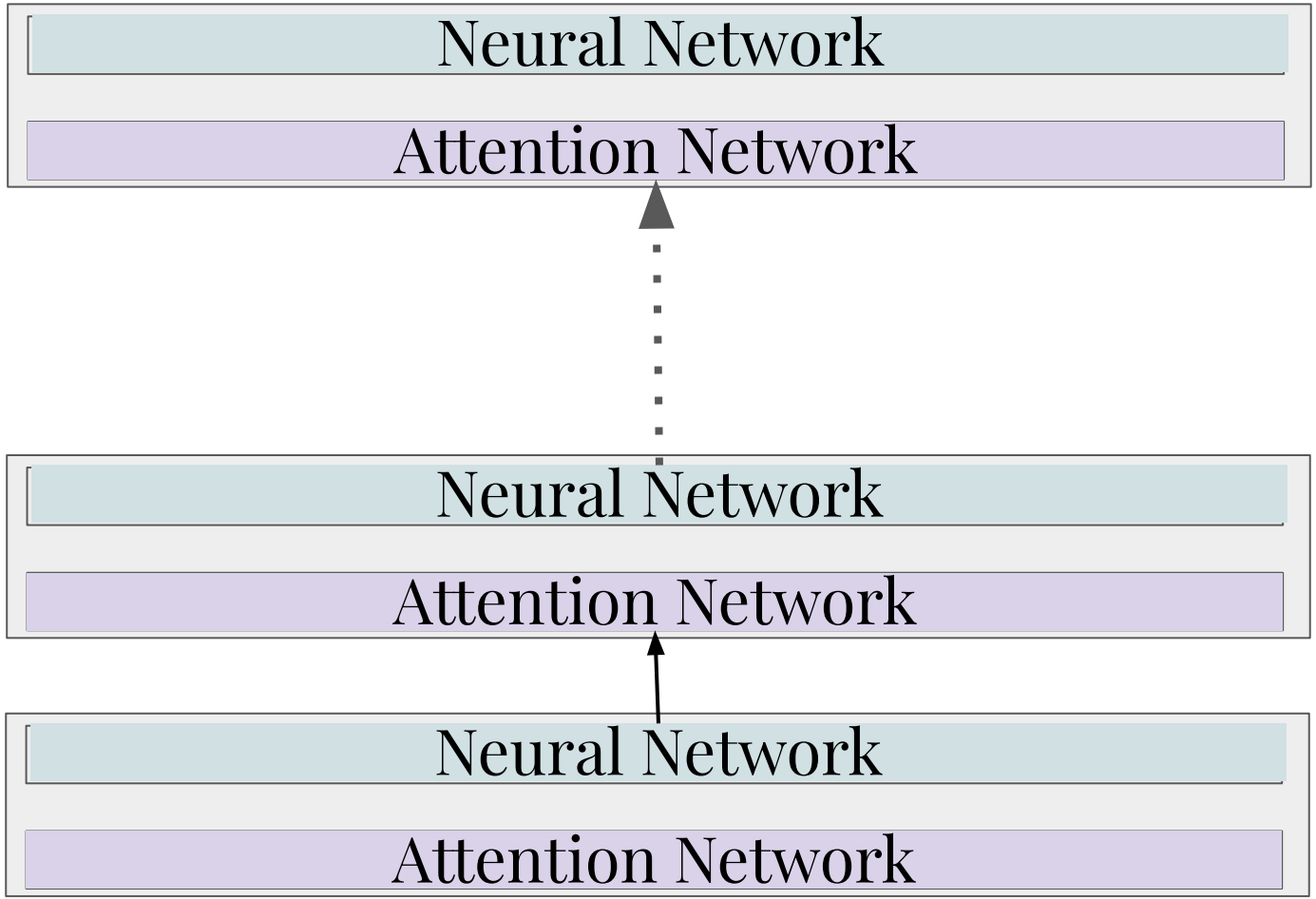
Preprocessing of data has been used throughout the course

Transformer Network: Attention network creates the connections, neural network finds the patterns

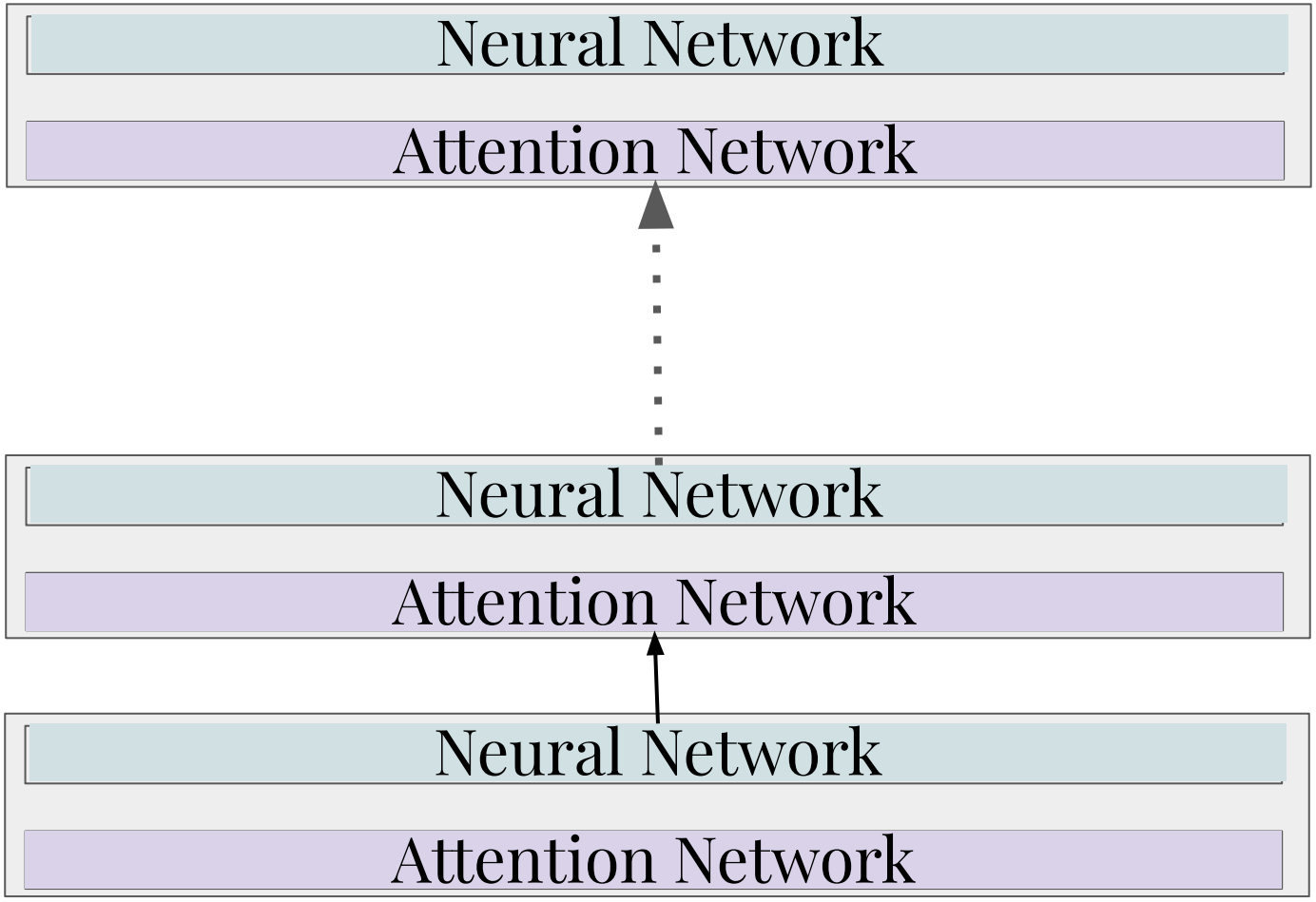



Transformer Network
Neural Network
Attention Network

Chat Bots


Neural Network
Attention Network
Neural Network
Attention Network
Neural Network
Attention Network

Semantics



Syntax

ChatGTP-3

- 96 Transformers
  - Hundreds of billions of parameters
- Trained with the entire internet and all openly available books
  - Trillions of training points
- Trains in 355 years on a single GPU
  - Trains in a month with thousands of GPUs