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# Neural networks capable of finding medication complaints in social networks

"I am a little  
giddy"



"I Cannot get  
asleep all  
night"

# Introduction

- Researchers from Kazan Federal University and Moscow Institute of Physics and Technology found designed an artificial neural network capable of finding medication complaints in social networks
- Social media provides huge datasets of people's opinions complete with demographic information and often much more detailed data regarding a specific user
- Harnessing this data, we can train a computer to make informed predictions about the user

# High Level Implementation



# Medical Concept Normalization

Social Media Language

Formal Medical Language

"I am a little  
giddy"



insomnia

"I Cannot  
get asleep  
all night"



dizziness

Bridging the gap between the language of the lay public and medical professionals

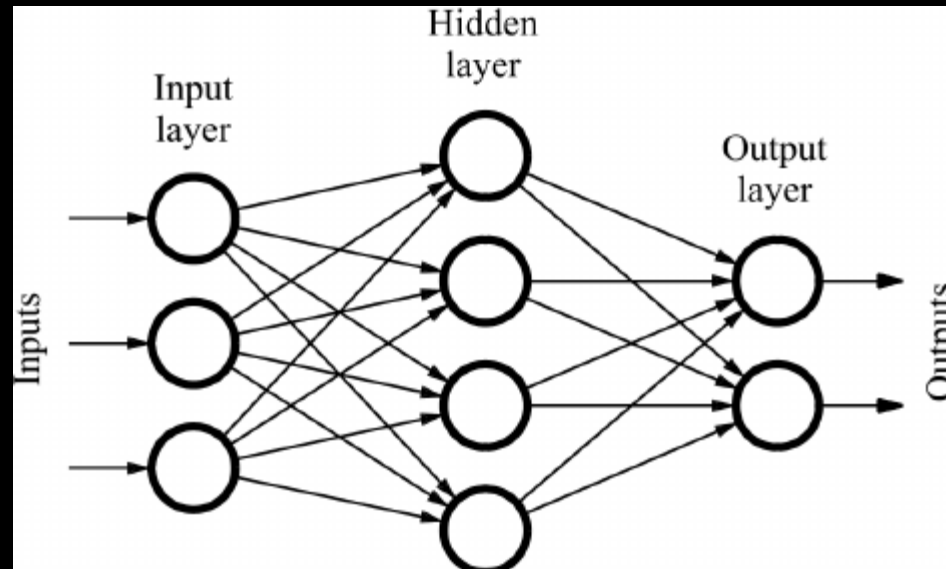
# Problem

- Social network data usually contains a lot of noise:
  - Misspelled words
  - Incorrect grammar
  - Abnormal characters or phrases (e.g. hashtags)
  - Abbreviations
  - Different variations of the same word
- How can we process social media data despite all this noise?

# Recurrent Neural Networks

# Neural Network

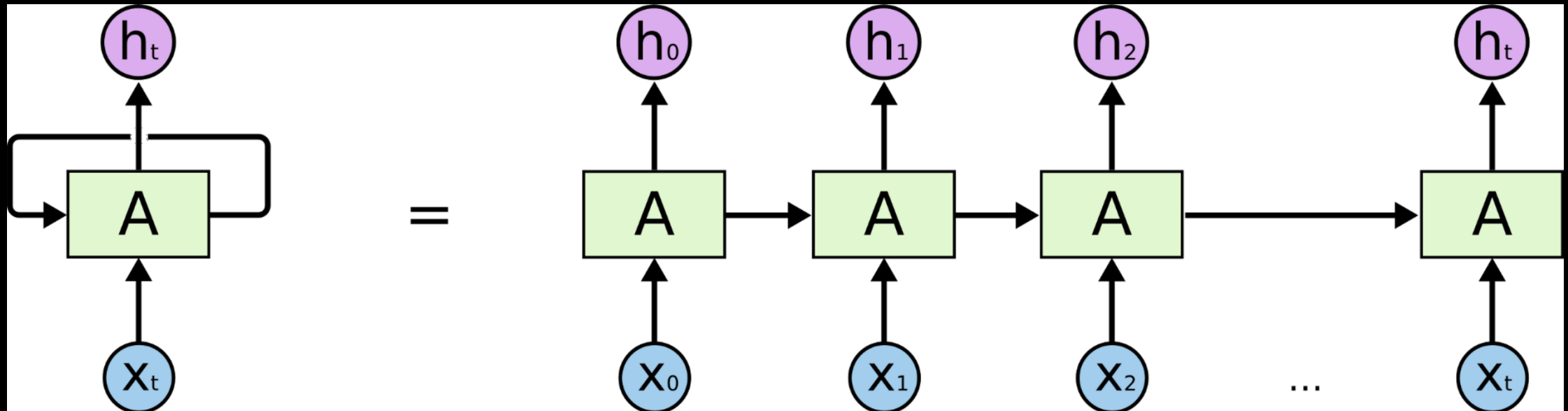
- A computational graph
- Simplest kind of NNs are Feed-Forward Networks
- One layer in a FFN is a transformation of an input vector to a output vector by multiplying it by some weight matrix and applying some non-linear function afterward

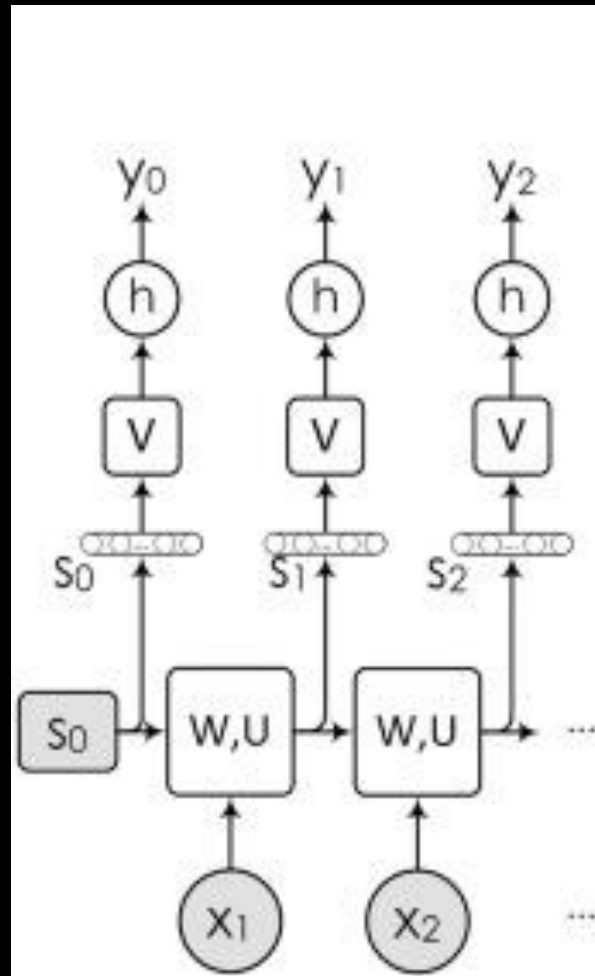




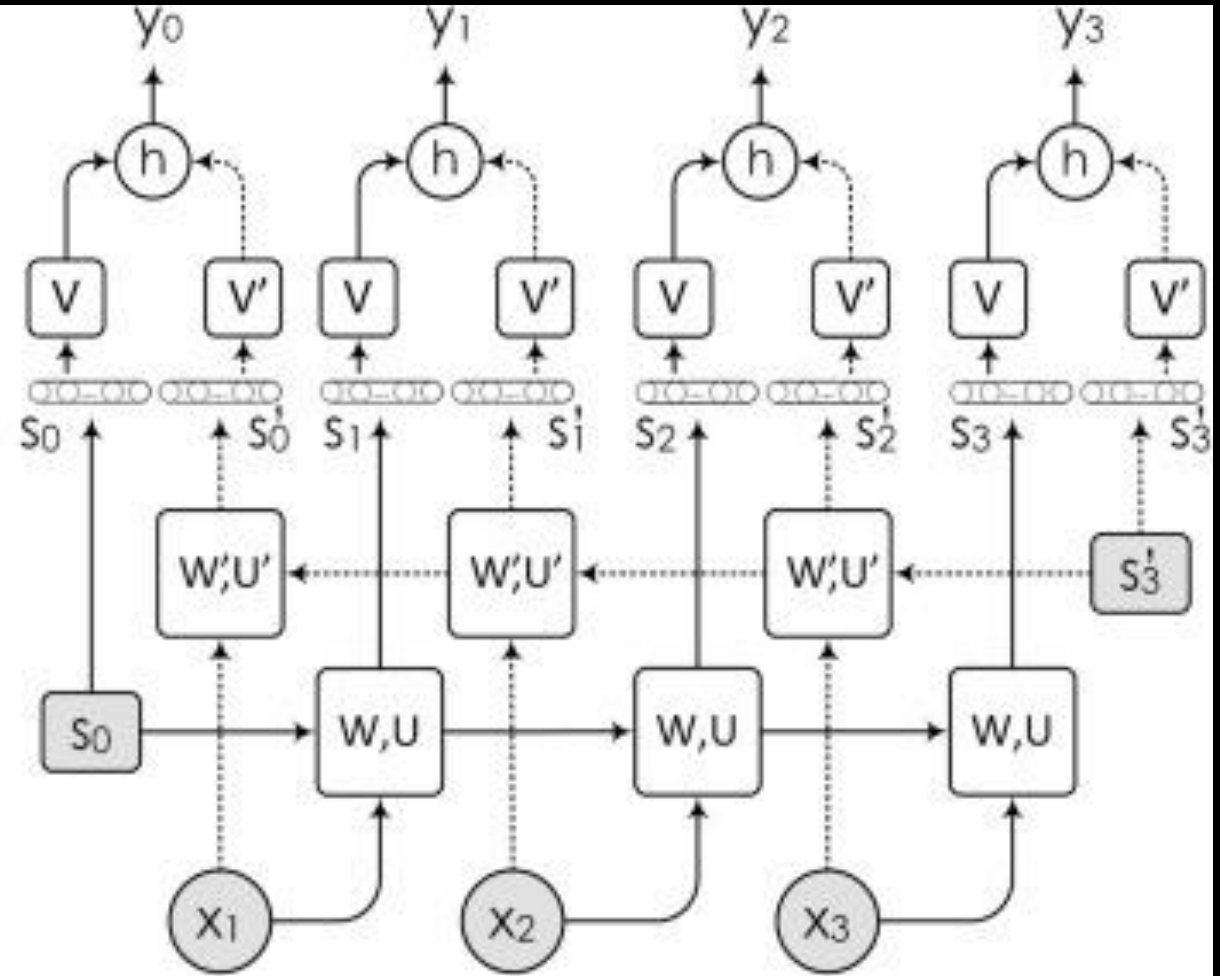
# Recurrent Neural Networks

- Class of artificial neural network where connections between units form a directed graph along a sequence
- Exhibit dynamic temporal behavior
- RNNs can use their internal state to process sequences of inputs





(a)



(b)

# Utilizing the RNN

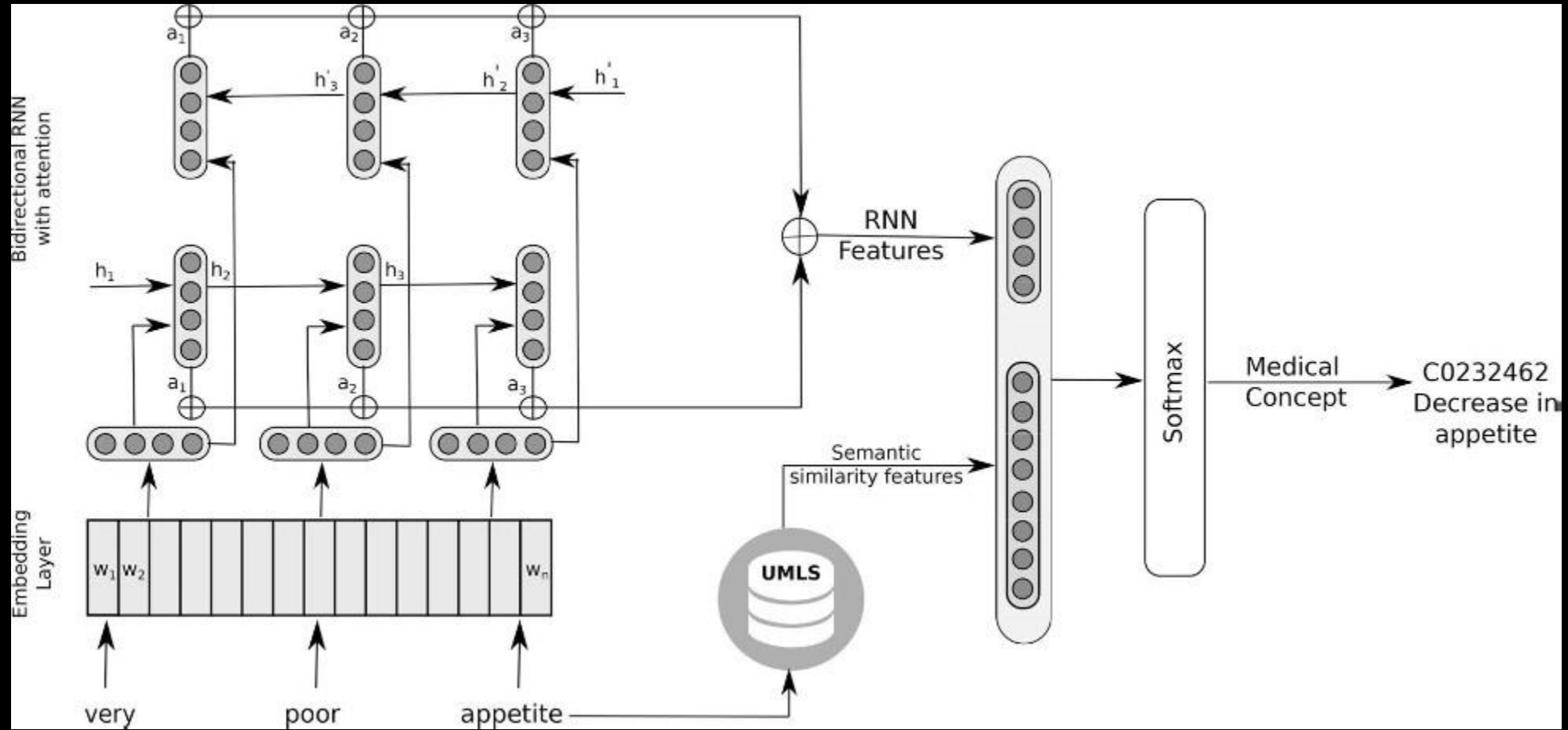
1. Medical texts were uploaded to the model, and a special vocabulary was created
2. Model used vocabulary to assign a vector for each input word
3. Upload social media texts to model
4. Compares them to the medical vocabulary
5. The outputs are word vectors
  - Words and terms often encountered in a similar context are assigned similar meaning
  - Essentially, the neural network “compares” user texts and official medical terms

# Another Look



Recurrent neural networks work well with serialized data because they can find links between elements while taking consideration of the context.

# Current Learning Model



# Conclusion

- The following text analytics method of diagnosing a patient can also be used to directly rather than a separate medium
- We can return full circle and use this data to understand how a particular symptom effects the user
- This study shows that we can potentially train computers to understand and interpret other human behaviors
  - Find meaning from other social media posts
  - Overall better understanding of human slang

# Citation

- “Artificial Neural Network Now Capable of Finding Medication Complaints in Social Networks.” *Artificial Neural Network Now Capable of Finding Medication Complaints in Social Networks*, Kazan Federal University, 17 Sept. 2018, [kpfu.ru/eng/news-eng/artificial-neural-network-medication-text-analysis.html](http://kpfu.ru/eng/news-eng/artificial-neural-network-medication-text-analysis.html).
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- Tutubalina, Elena. “Medical Concept Normalization in Social Media Posts with Recurrent Neural Networks.” *NeuroImage*, Academic Press, 12 June 2018, [www.sciencedirect.com/science/article/pii/S1532046418301126](http://www.sciencedirect.com/science/article/pii/S1532046418301126).