



# Seizure Detection Using AI

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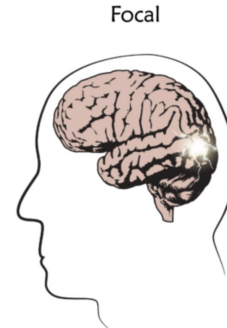
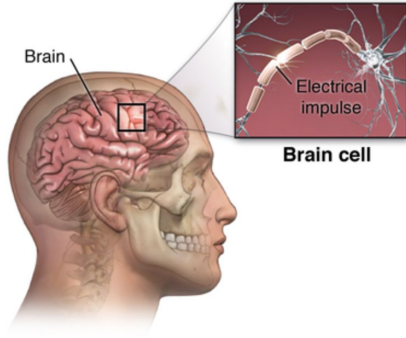
# Overview

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# Epilepsy Overview

Epilepsy: a chronic disorder that occurs when a person experiences two or more seizures

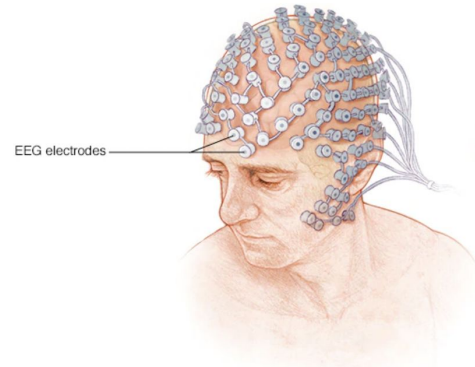
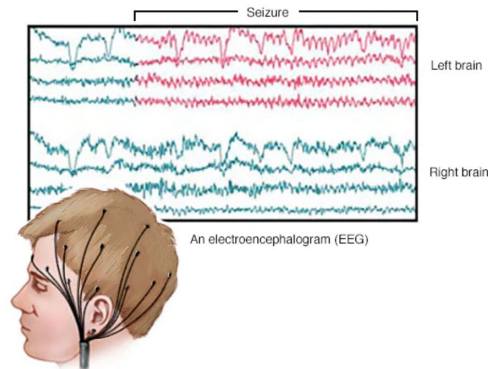
Goal: Use electronic patterns in the brain to detect seizures.



# Overview

EEG (electroencephalogram) - electrophysiological technique for recording electrical activity in the human brain

**Goal: Use EEGs to find seizure-specific patterns in patients.**





## UCI Epileptic Seizure Recognition Data Set

★ No seizures: 80%

★ Seizures: 20%

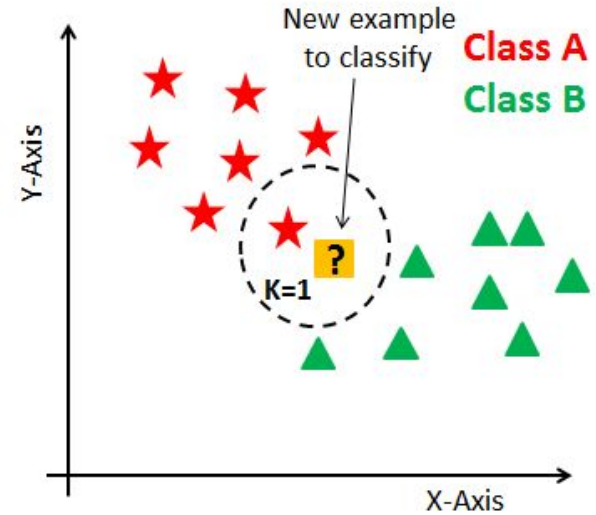
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# First Approaches

# First Approaches

## K-Nearest Neighbors

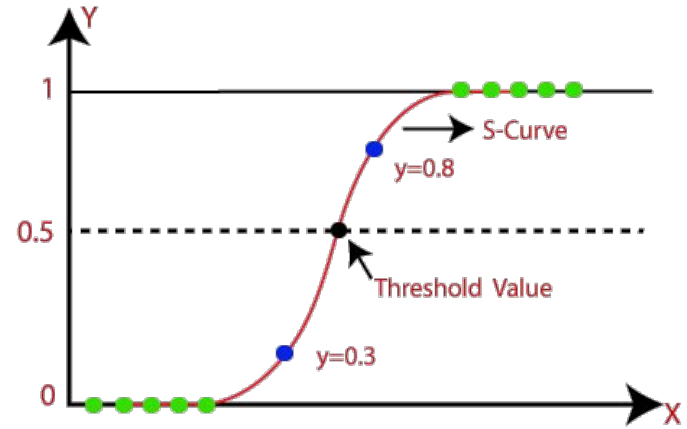
K Value	Accuracy
1	.845
3	.815
5	.805
10	.79
20	.79



# First Approaches

Logistic Regression

Accuracy: .615

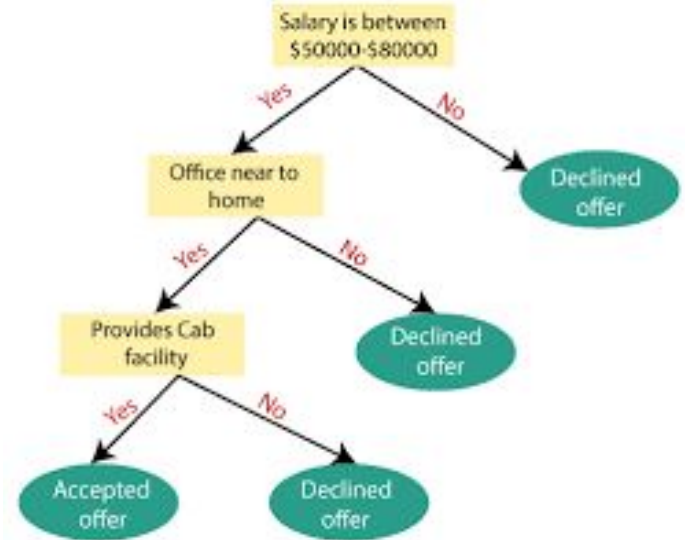




# First Approaches

## Decision Tree Classifier

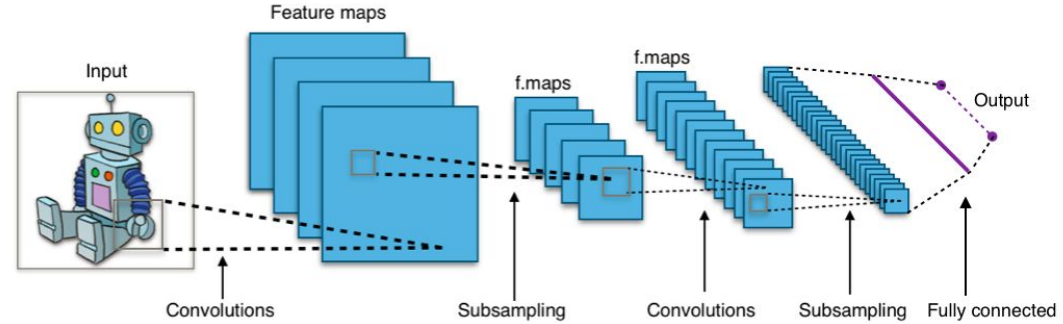
Max Depth	Accuracy
2	.875
5	.925
10	.935
20	.92
50	.94



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# Next Models [CNN]

# Next models (CNN)



CNN's are meant for image classification

Our CNN inputs images of EEG Spectrograms

Convolutional Layers- sliding window that identifies features

Max Pooling Layers- lowers resolution, reduces complexity

**Test Accuracy: 90%**

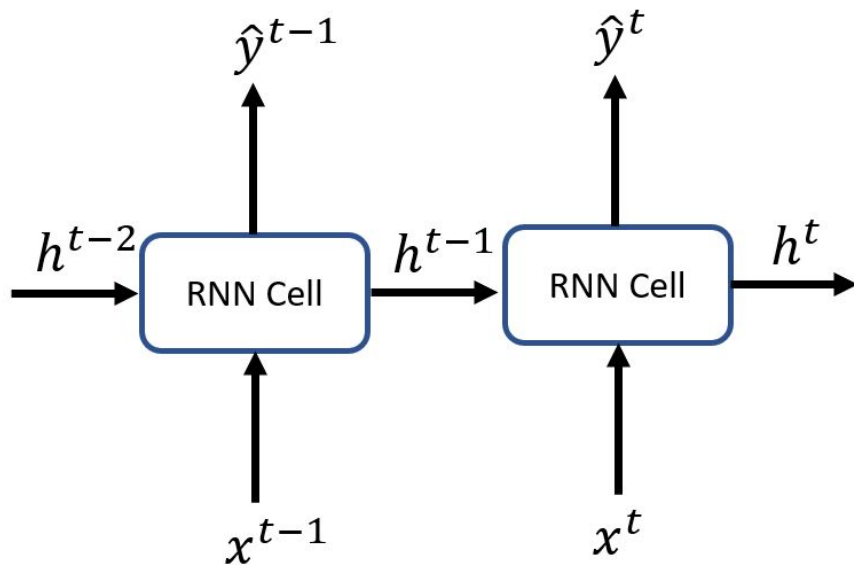
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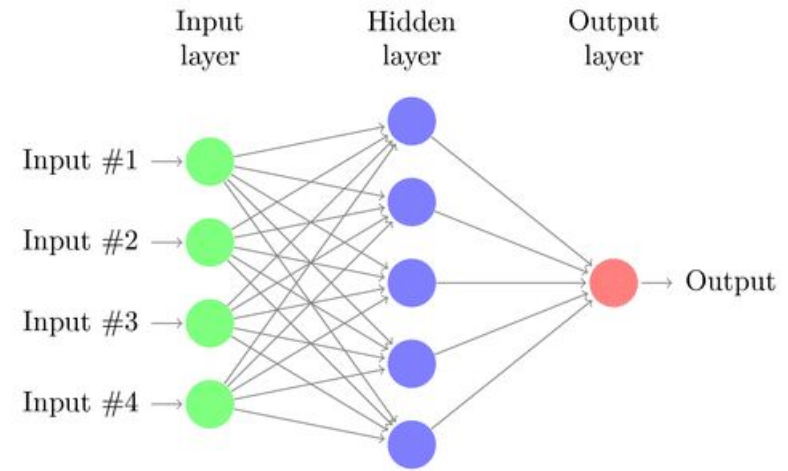
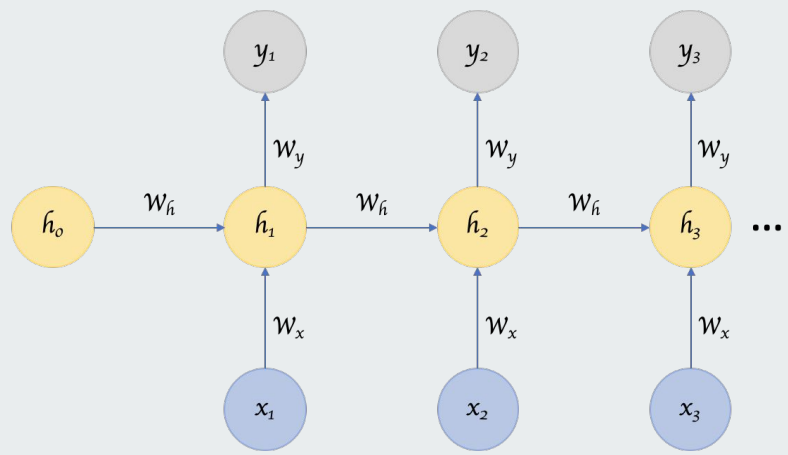
# Final Models [RNN]



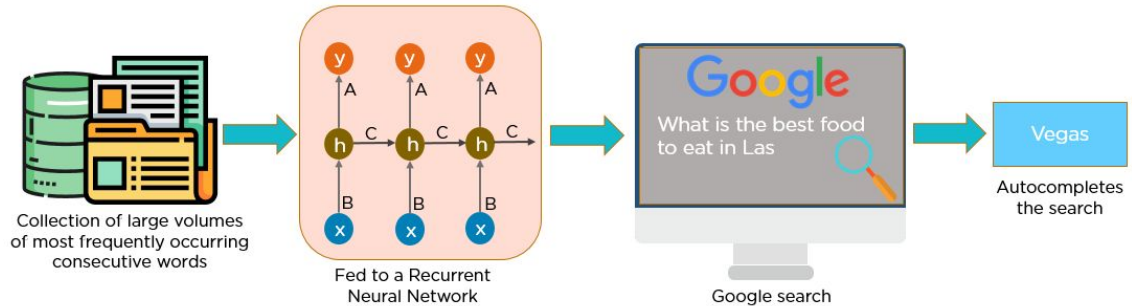
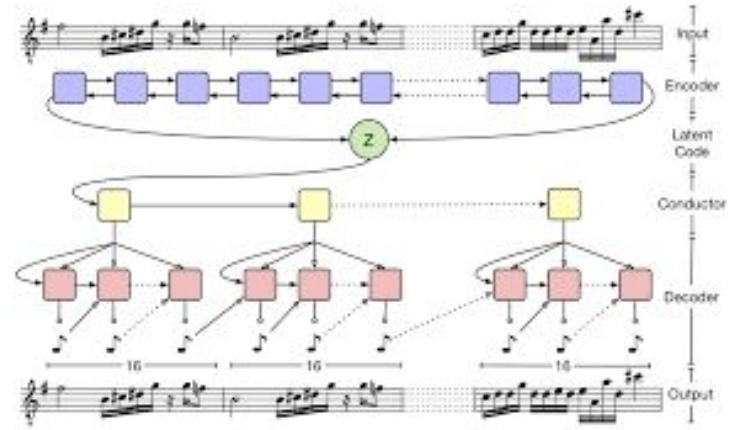
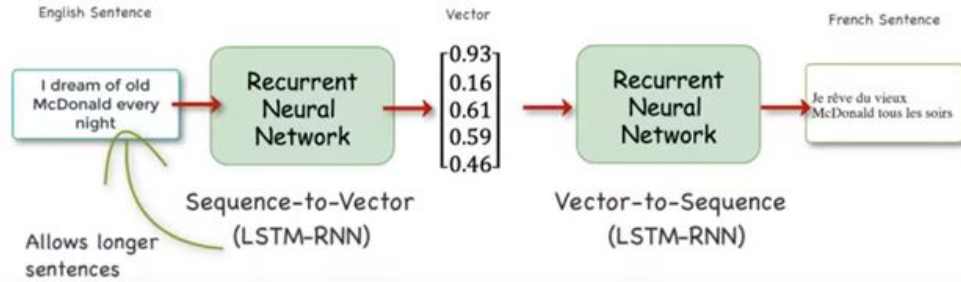
## What is an RNN?



# RNN v. NN



# Other Examples





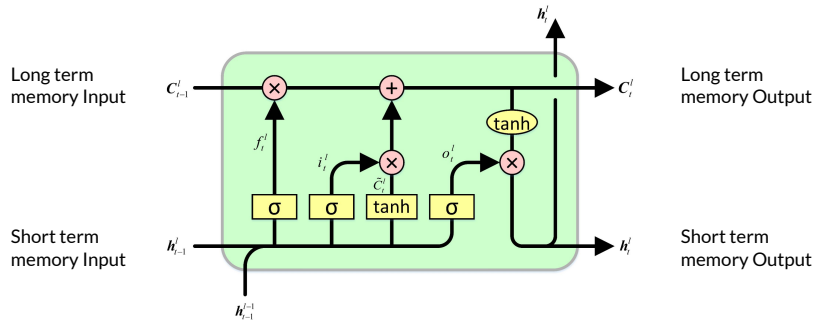
**Test Accuracy: 78%**

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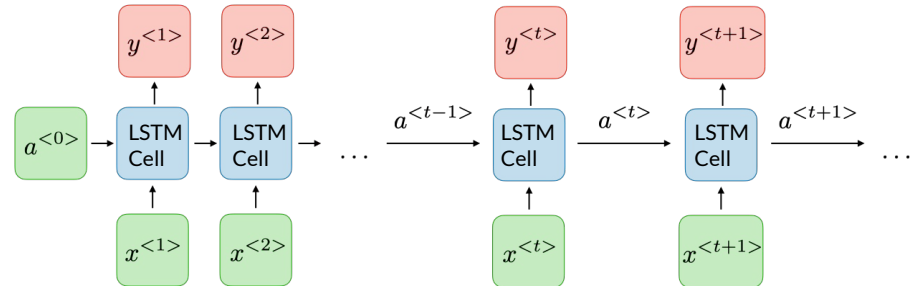
# Final Models [LSTM]

# Final models (Long Short Term Memory, LSTM)



Cell Structure

Model Structure



Sources:

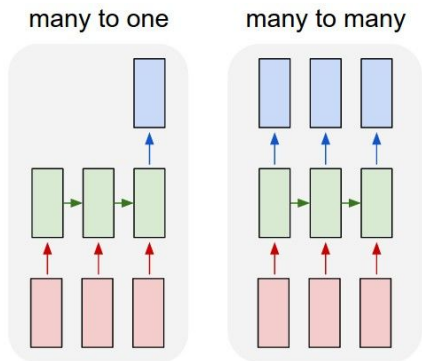
<https://stackoverflow.com/questions/50488427/what-is-the-architecture-behind-the-keras-lstm-cell> (Left)

<https://stanford.edu/~shervine/teaching/cs-230/cheatsheet-recurrent-neural-networks> (Right)

**Test Accuracy: 89%**

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# Exploring Different Structures

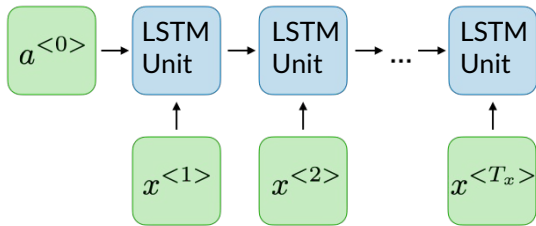


Source:

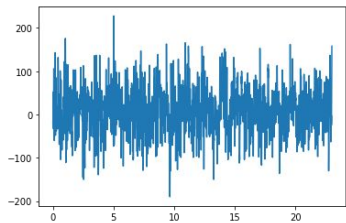
<https://stackoverflow.com/questions/43034960/many-to-one-and-many-to-many-lstm-examples-in-keras>

# Many-to-One Prediction

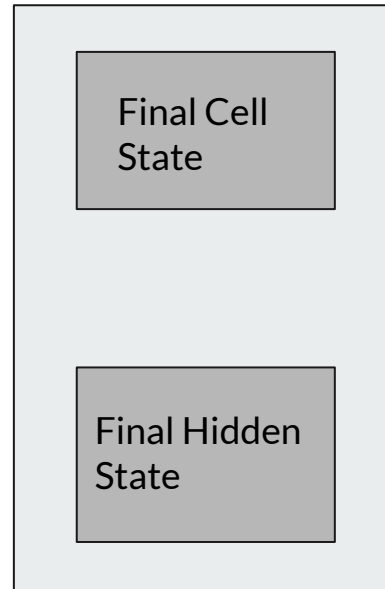
Sequence Processing with LSTM



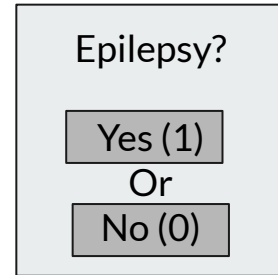
Sequence Data Input



Final State Vectors



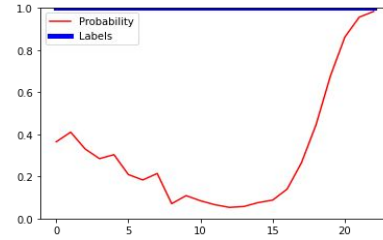
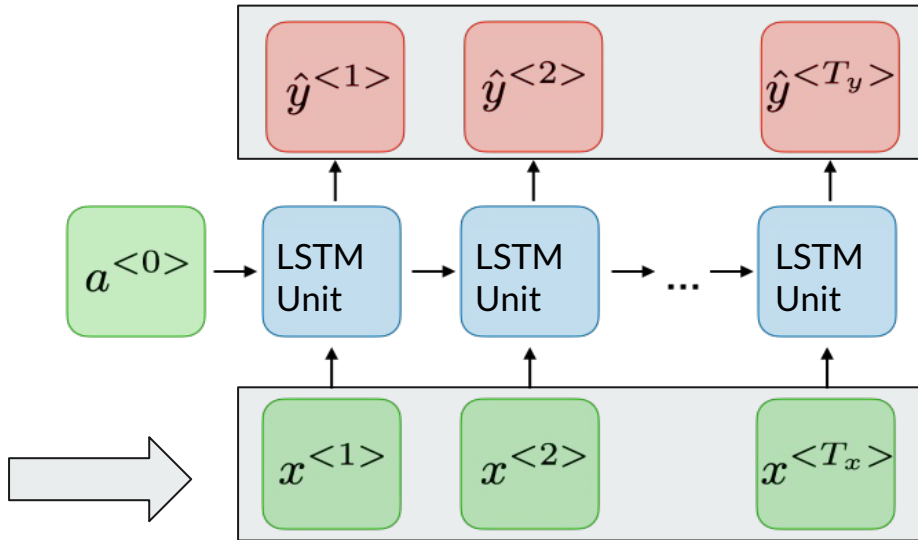
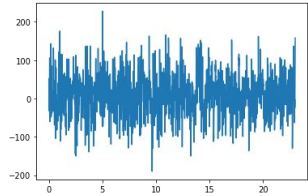
Predictions



# Many-to-Many Prediction

Sequence Processing with LSTM

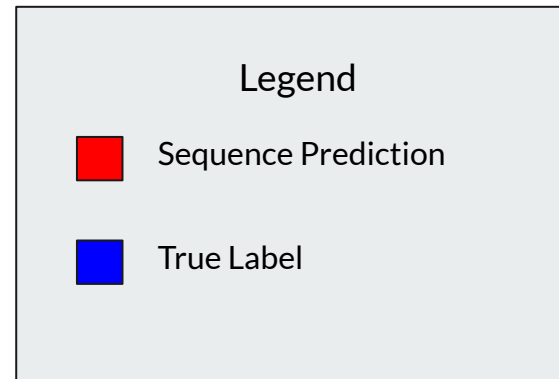
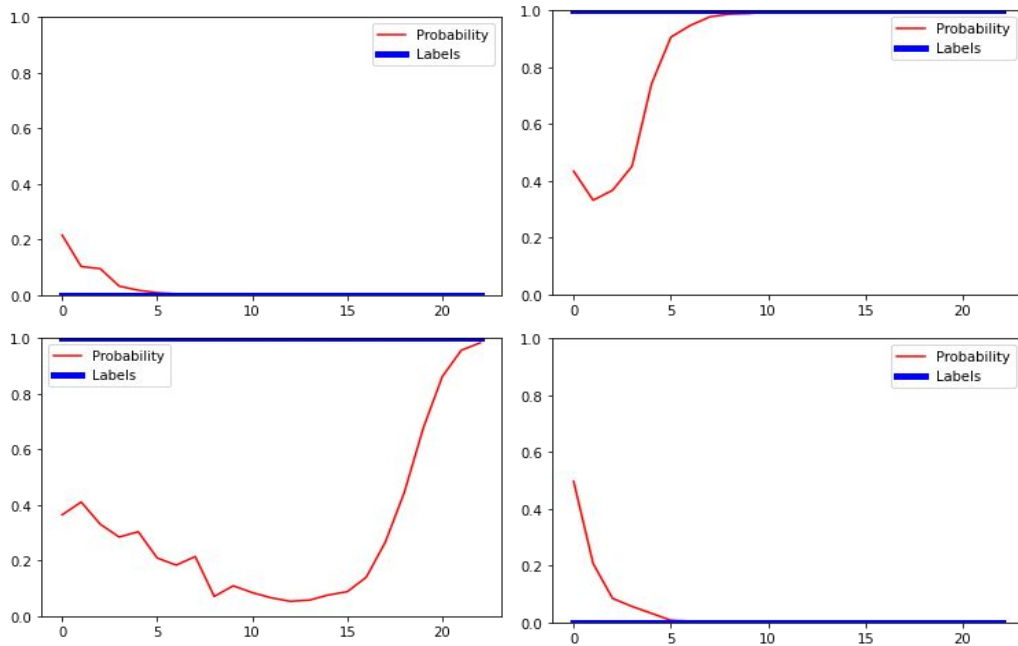
EEG Sequence Input



Seizure Sequence Prediction



# Prediction Visualization

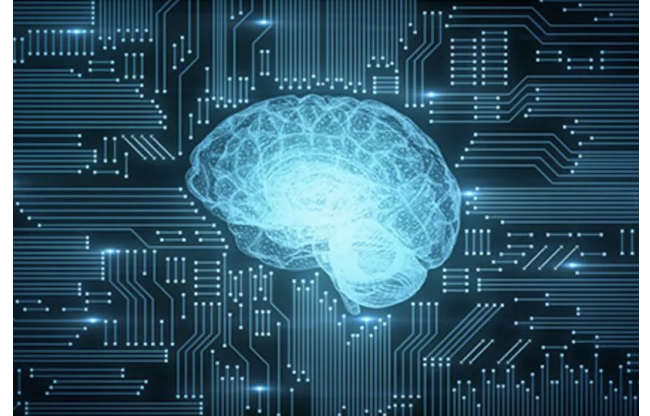




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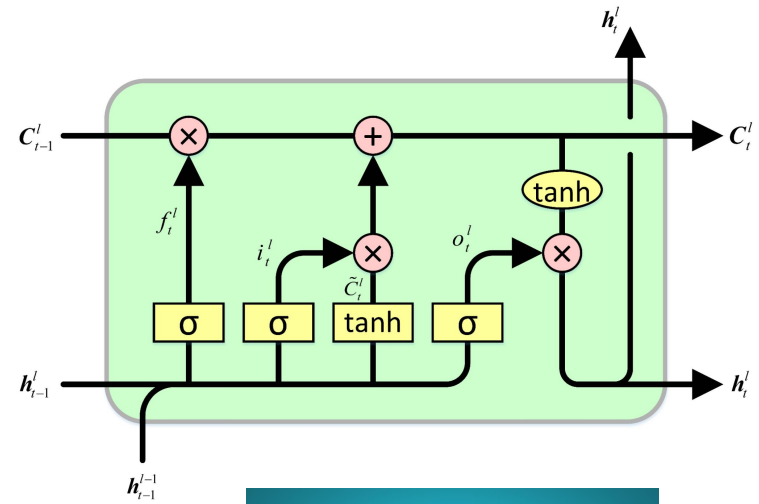
# Ethics

- ★ Patient Privacy
- ★ Should a doctor trust an AI model's decisions?
- ★ If there is a misdiagnosis by the AI model, who should take the responsibility?



## Conclusion

- ★ The Final Model
- ★ Further improvement
- ★ Uses for the Future





**Thank you for  
listening!**



## Sources

1. <https://www.hopkinsmedicine.org/health/conditions-and-diseases/epilepsy/evaluation-of-a-first-time-seizure>
2. <https://www.epilepsyqueensland.com.au/about-epilepsy-epilepsy-queensland/seizure-types/what-are-the-different-types-of-seizures>
3. <https://www.mayoclinic.org/tests-procedures/eeg/about/pac-20393875>