RNN: Rhythm, Notes, and Neural Networks

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Introduction

- **Goal:** Discover if neural networks can produce a high-quality musical piece rivaling that of human composers.

- **Motivation:** Music is one of the most widely consumed forms of entertainment. Neural networks having the ability to enhance the composition process could lead to revolutionary changes in music production.
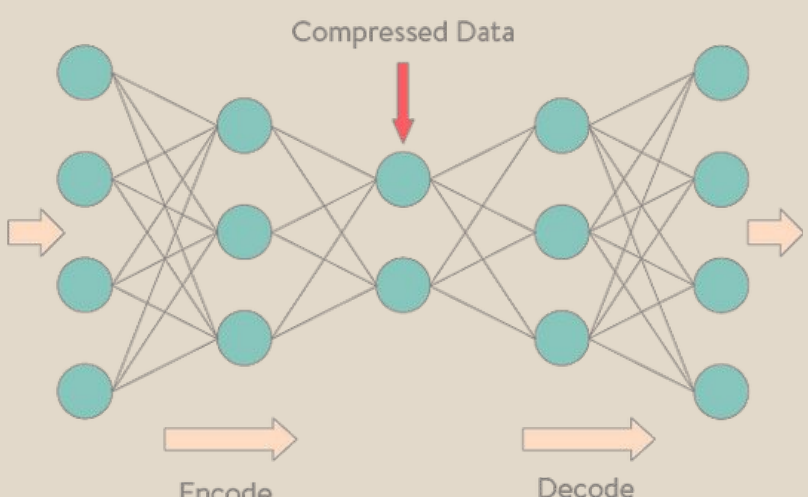
Approach
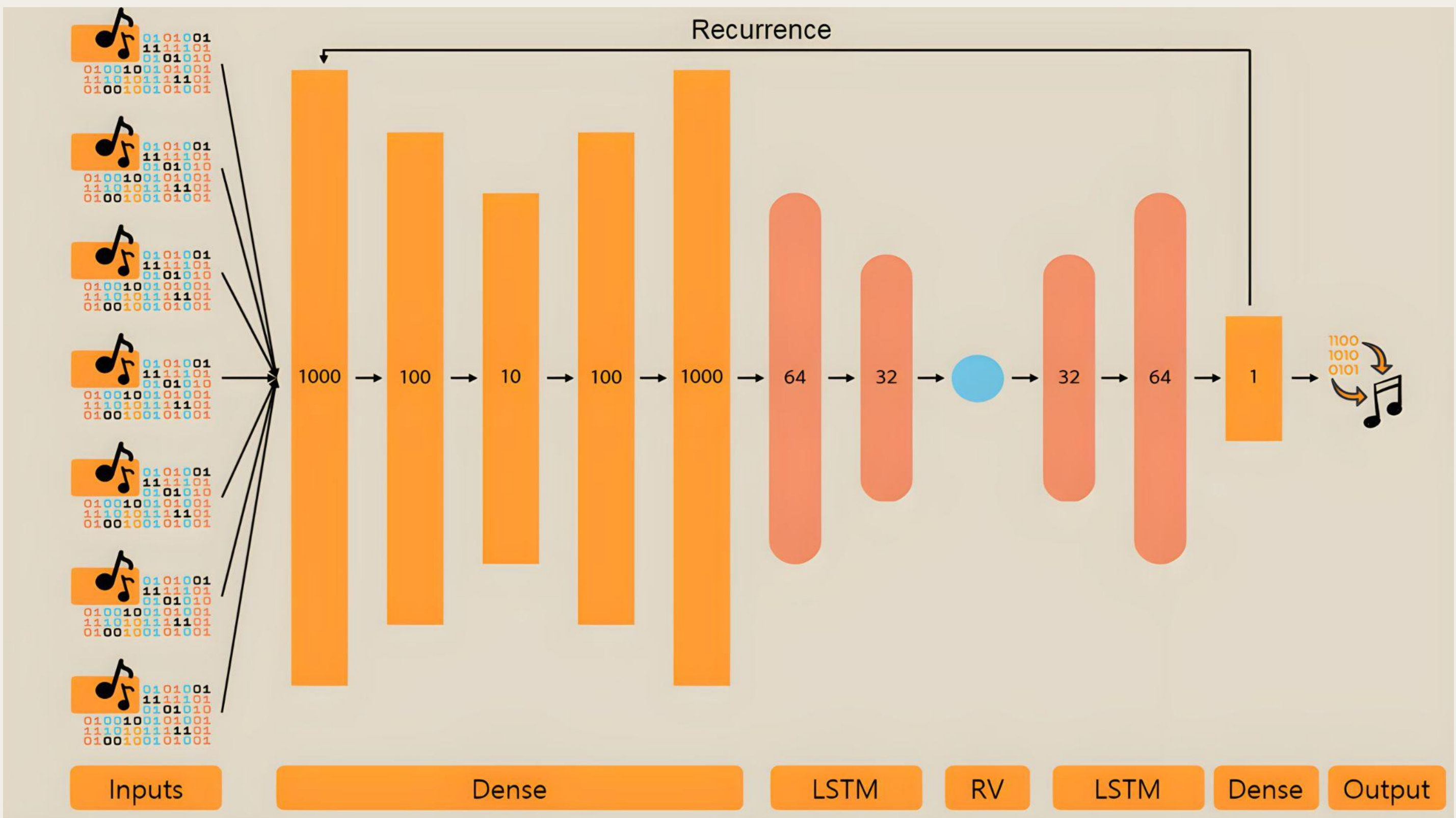
Recurrent Neural Network (RNN)
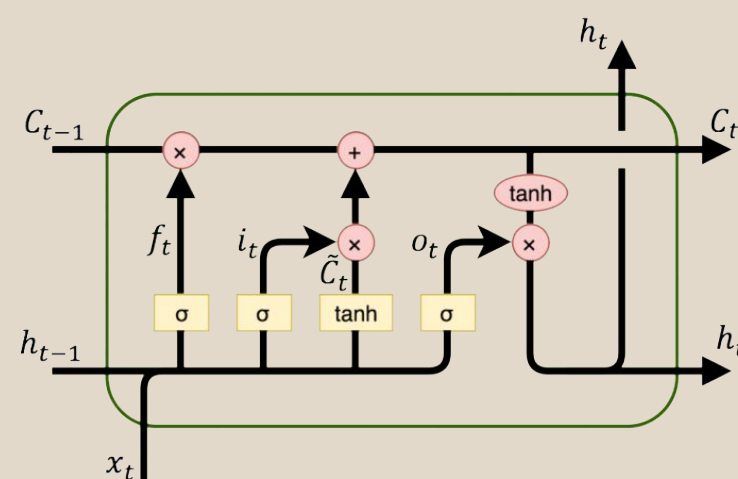
- Long Short-Term Memory (LSTM) network maintains a recollection of its past output.

Autoencoder

- Compress and decompress data to learn patterns / sequences.

Obtain	Encode	Create Model

• MIDI representations of classical songs
• Distinguished by the composers
	• MIDI songs into matrix format
	• Ex. Note 55 = [0,0,...,1,0,0…]
		• Neural network:
		  ○ Autoencoder
		  ○ LSTMs
		  ○ Repeat Vector

Train Model	Outputs	Decode

• Train Network for a variety of epochs
  ○ 50, 100, 250, 500, and 1000
	• Network output
	  ○ 2D binary vector (like inputs)
		• Convert into MIDI representation
		• Note-on, note-off, pitch values.

Neural Network Model

Results

- **AutoEncoder + LSTMs:**
  ○ A large variation of results, but still better overall performing than LSTM-only.
  ○ Learning the best structure is difficult due to its complexity.

- **Epochs:**
  ○ A small number of epochs generates simple music.
  ○ Typically, a large number of epochs generates music with a complex scale.
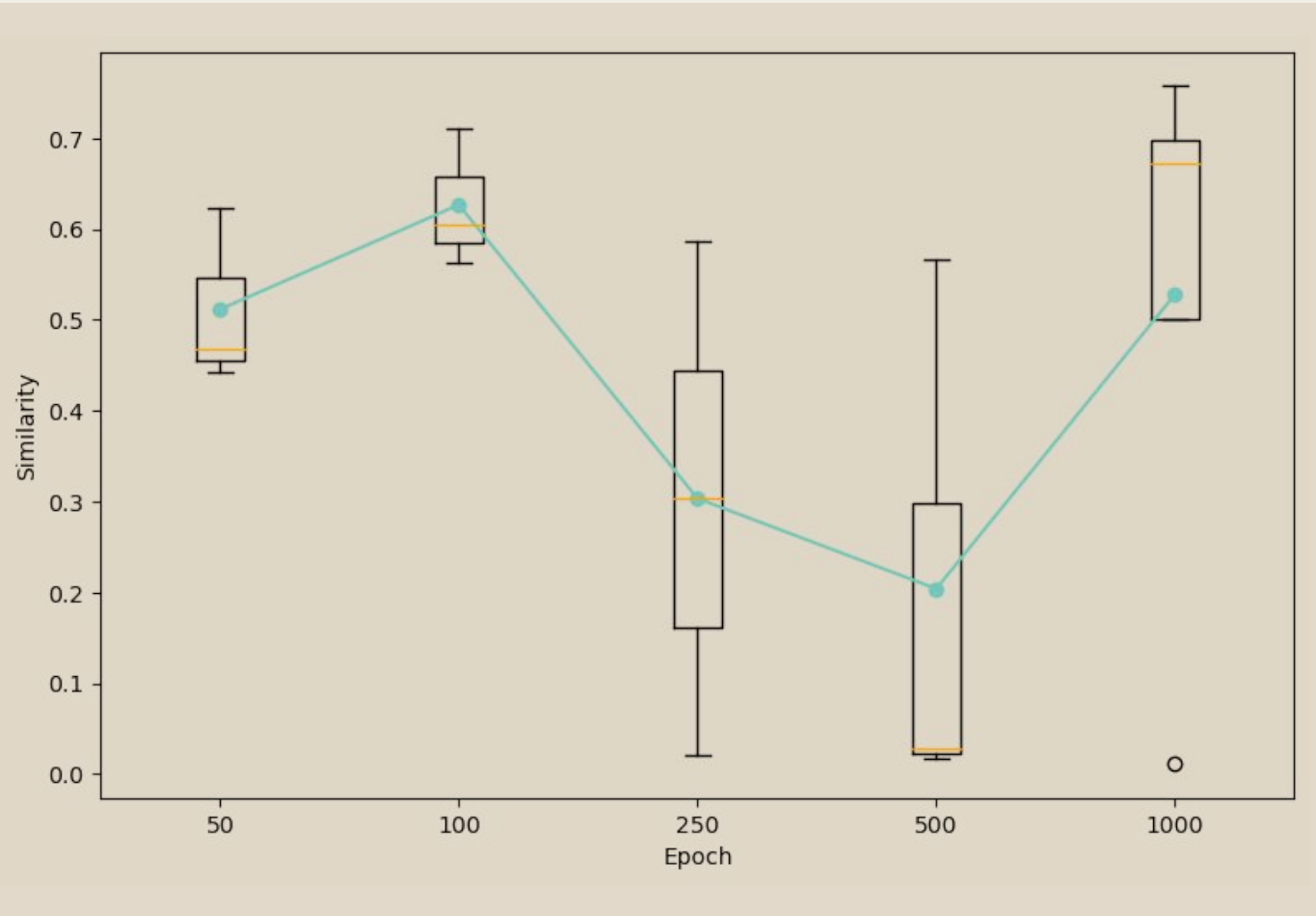
Conclusion

- **MIDI Improvement:**
  ○ Most MIDI files are very complex (variations, tempo, chords, etc.).

- **Network Improvement:**
  ○ Since neural networks are a vast field of study, there are countless compositions of these networks to test.

- **Music Theory:**
  ○ Music composition requires rather in-depth knowledge and experience.