Synthesis of Realistic Tongue Movements for Speech Animation using Gated Recurrent Units

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Motivation

- Speech animation has long focused on lip-sync and facial movements, neglecting the tongue's role in articulation, which is critical for achieving realistic character animations [2].
- Machine learning has shown potential in speech animation [3]; however, these techniques have not been fully utilised for tongue synthesis.

Contribution

- This paper presents a method for synthesising realistic tongue movements from speech inputs using machine learning, specifically Gated Recurrent Units (GRUs).
- By leveraging a dataset of Electro-Magnetic Articulography (EMA) [1], various neural architectures, such as Long Short-Term Memory (LSTM) networks, transformers, and GRUs are evaluated.

Methodology

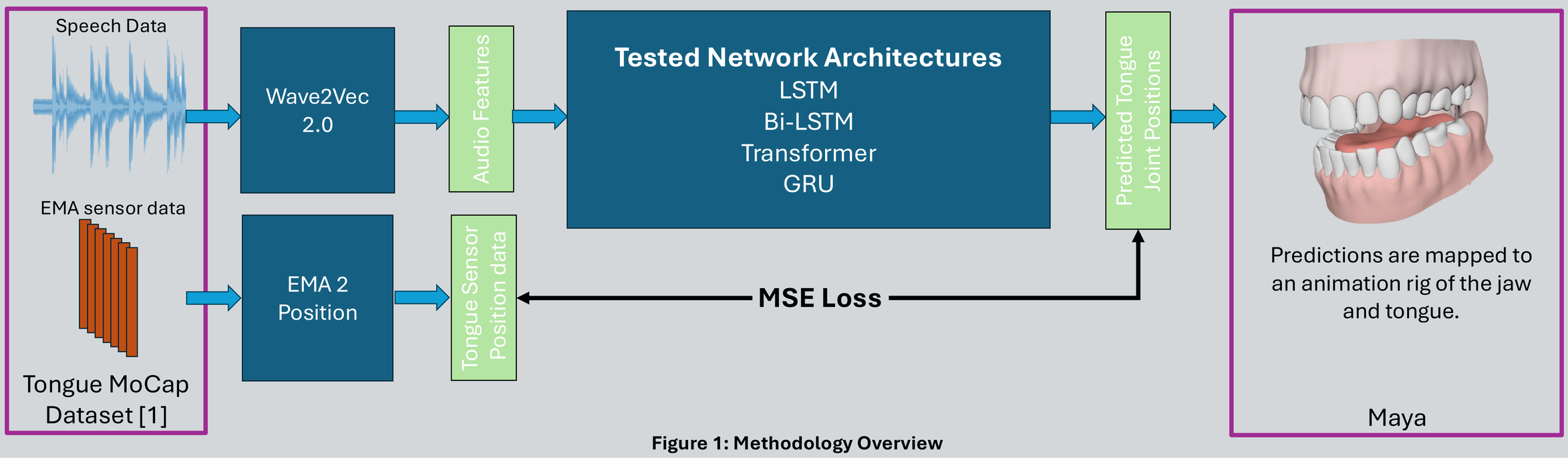


Figure 1: Methodology Overview

Results

Table 1: Comparing model architectures

Model Architecture	MSE
LSTM	2.267
Bi-LSTM	1.715
Transformer	2.216
GRU	**1.688**

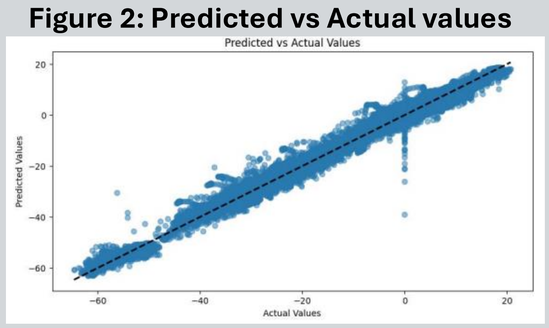
Table 2: GRU hidden dimension

Hidden Dimension	MSE
64	1.751
128	1.688
256	**1.598**
512	1.638

Table 3: GRU hidden dimension

Number of Layers	MSE
2	1.715
3	1.598
4	**1.559**
5	1.674

Figure 2: Predicted vs Actual values



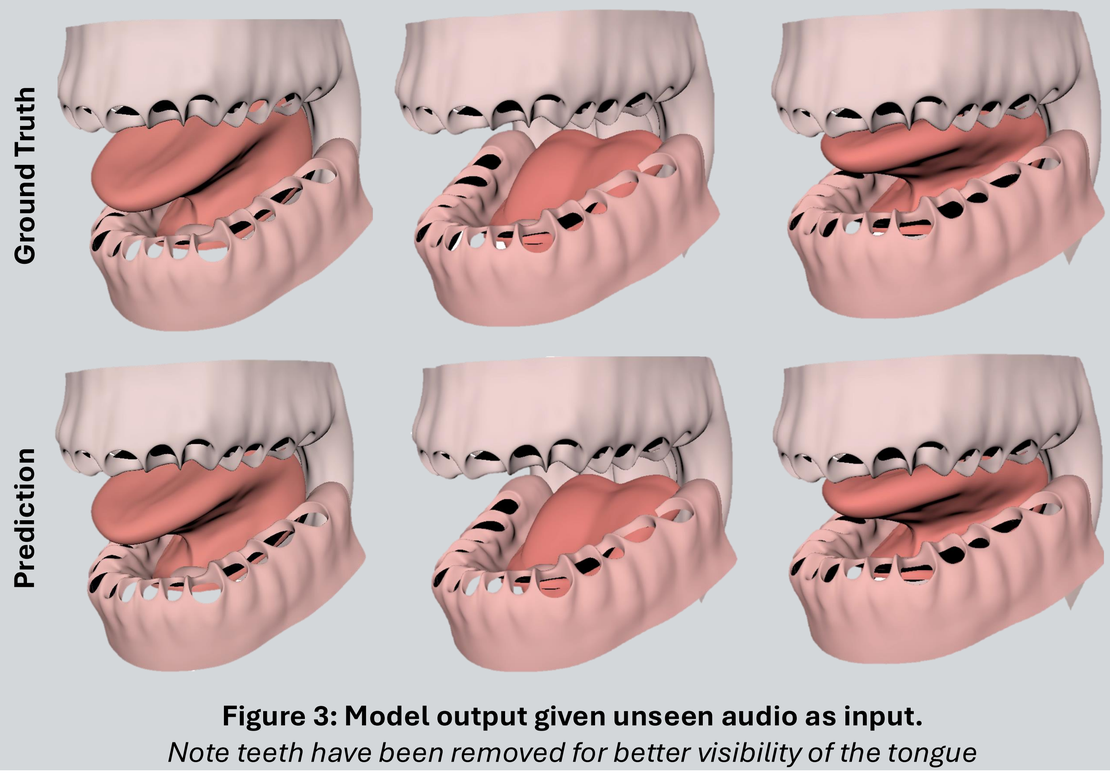


Figure 3: Model output given unseen audio as input.
Note teeth have been removed for better visibility of the tongue

Conclusions

- This work successfully developed a GRU-based approach for synthesising realistic tongue movements from speech inputs.
- The proposed method has the potential to enhance the realism of speech animations in digital characters, with applications in fields such as gaming, film, and VR.

References

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