SPEED ACCURACY TRADEOFF IN SPEECH PRODUCTION

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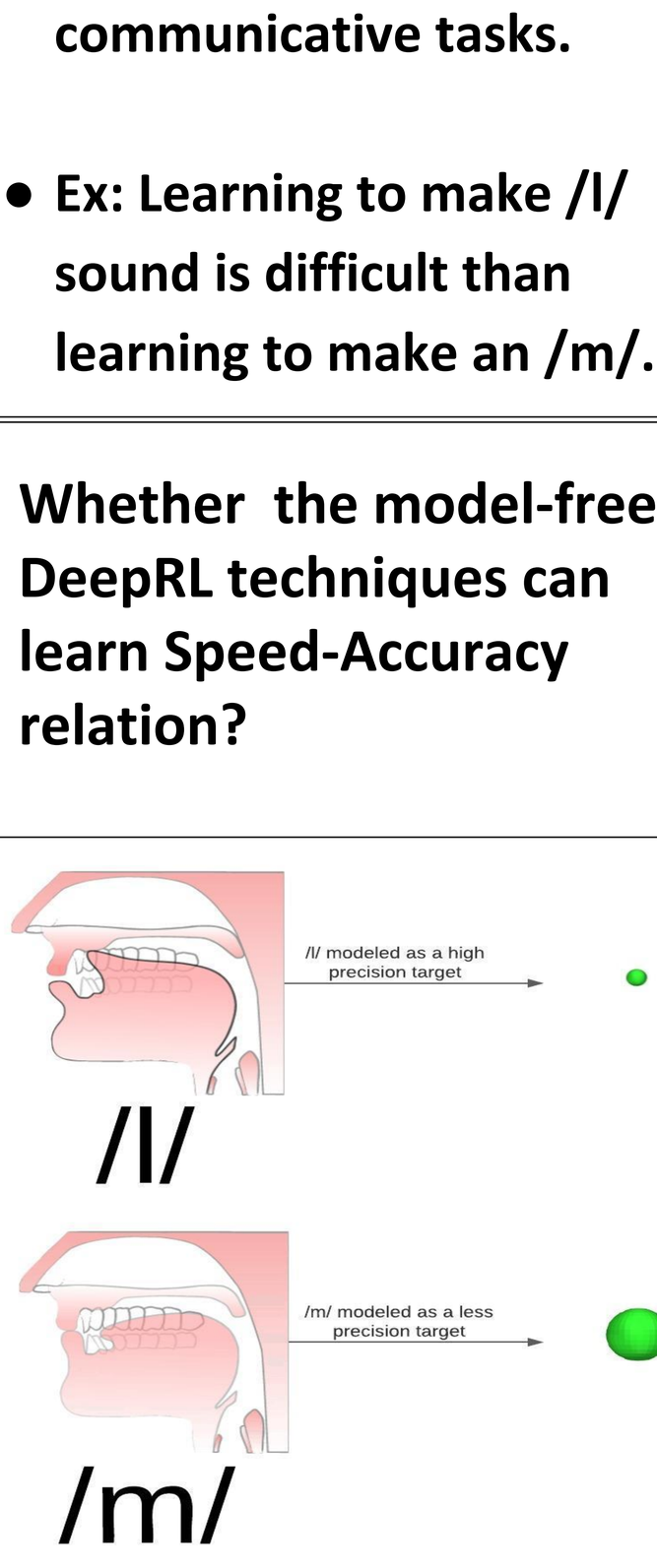
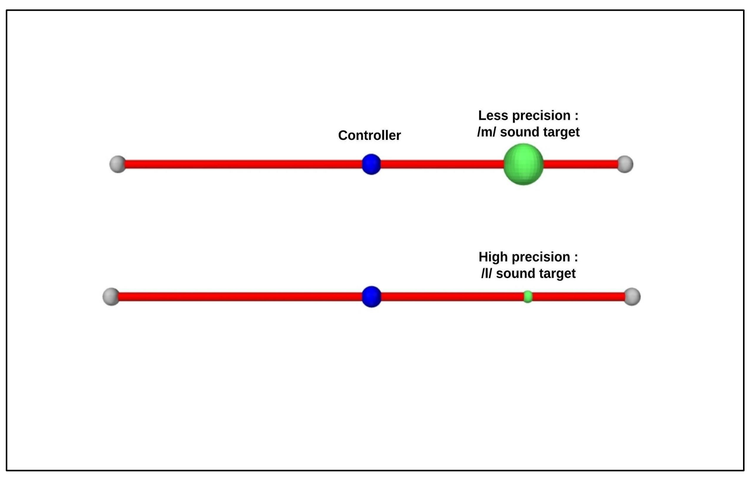
Motivation & Introduction

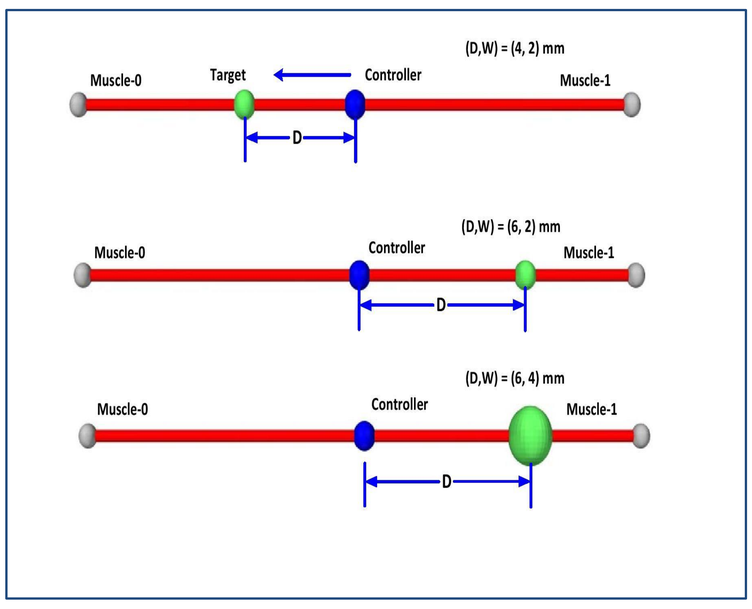
- **Speech is a complex biomechanical process.**
- **Speech based tasks require high precision while maintaining enough speed .**
- **Articulatory, acoustic, prosodic, and communicative tasks.**
- **Ex: Learning to make /l/ sound is difficult than learning to make an /m/.**

Whether the model-free DeepRL techniques can learn Speed-Accuracy relation?



Biomechanical task and Training details





- **The problem is shown in the above figure in biomechanical space.**
- **It captures the fundamental mechanism present in the advanced biomechanical models.**
- **Computing muscle activations given different tasks with varying complexity levels and observe the behavior of the agent.**

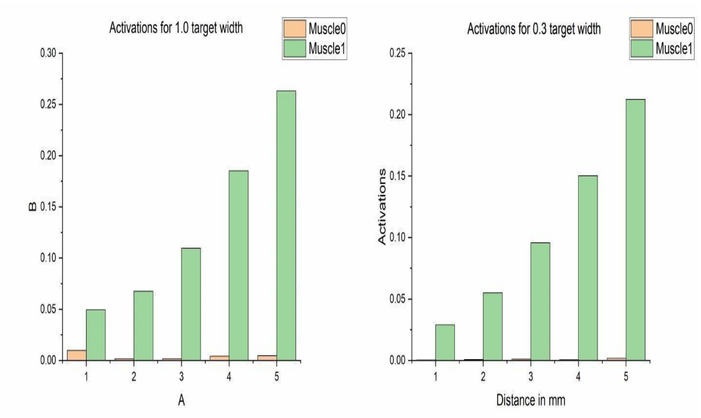
Results & Discussion

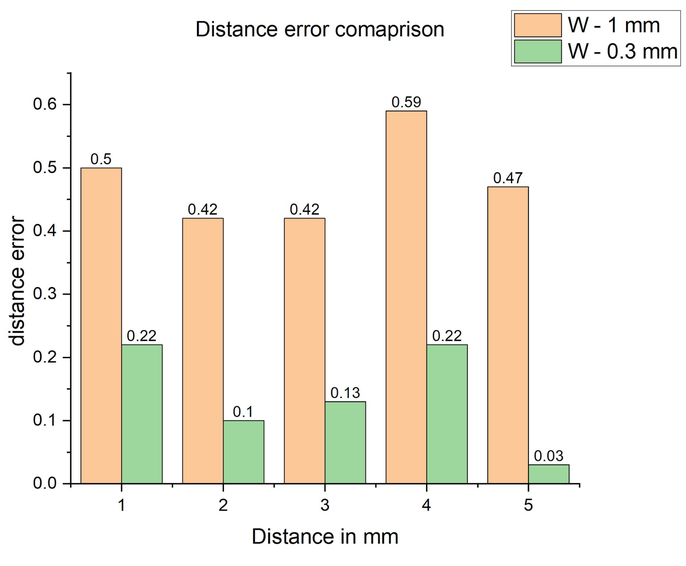
- **Reward:** $R = d_r - aa^T$

  Where d_r **is the done reward, a is a vector of activations.**

$$R = \begin{cases} d_r = 1 & \text{for } targetposition \leq controllerposition < targetposition + targetwidth \\ d_r = -5 \end{cases}$$

Distance	Width	Muscle0	Muscle1	Terminal State
1	1	0.009965	0.049516	[1.50, 0, 0]
2	1	0.001757	0.067634	[2.42, 0, 0]
3	1	0.001792	0.109575	[3.42, 0, 0]
4	1	0.004425	0.185289	[4.59, 0, 0]
5	1	0.00466	0.2633	[5.47, 0, 0]
1	0.3	0.000518	0.029028	[1.22, 0, 0]
2	0.3	0.00074	0.055135	[2.1, 0, 0]
3	0.3	0.00123	0.095212	[3.13, 0, 0]
4	0.3	0.000627	0.15029	[4.22, 0, 0]
5	0.3	0.00187	0.2124	[5.03, 0, 0]





Conclusion & Future Direction

- **Estimated activations are ballistic in nature than a combination of ballistic and corrective.**
- **Agent has shown a slight variance in its behavior when the task parameter particularly target width is varied.**
- **Though the variance to the target width can be observed still this can be enhanced whic we plan to achieve as the future work.**

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