

USING DEEP LEARNING TO PROVIDE FEEDBACK FOR REMOTE PHYSICAL REHABILITATION



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OBJECTIVE

Train machine learning models to produce feedback for videos of physical therapy exercises taken with a smart phone.

BACKGROUND

- A Deep Learning Framework for Assessing Physical Rehabilitation Exercises (Vakanski et al.)
- OpenPose (Body_25 Model)
 - Skeletal extraction convolutional network model
- Python, Matlab, Jupyter Notebook

VALUE PROPOSITION

- Recovery time after injury can be extended when:
 - Exercises are performed ineffectively
 - Patients are discouraged from performing exercises due to lack of clear instruction
- Physical therapy sessions can be expensive
- Provide feedback for the quality of an exercise, given a smart phone recorded video

KEY REQUIREMENTS

- Analyze a video taken by a smart phone
- Model must be trained on at least one exercise
- Produce a numerical accuracy rating
- Provide feedback in a reasonable amount of time
- Extract movement data from joint positions

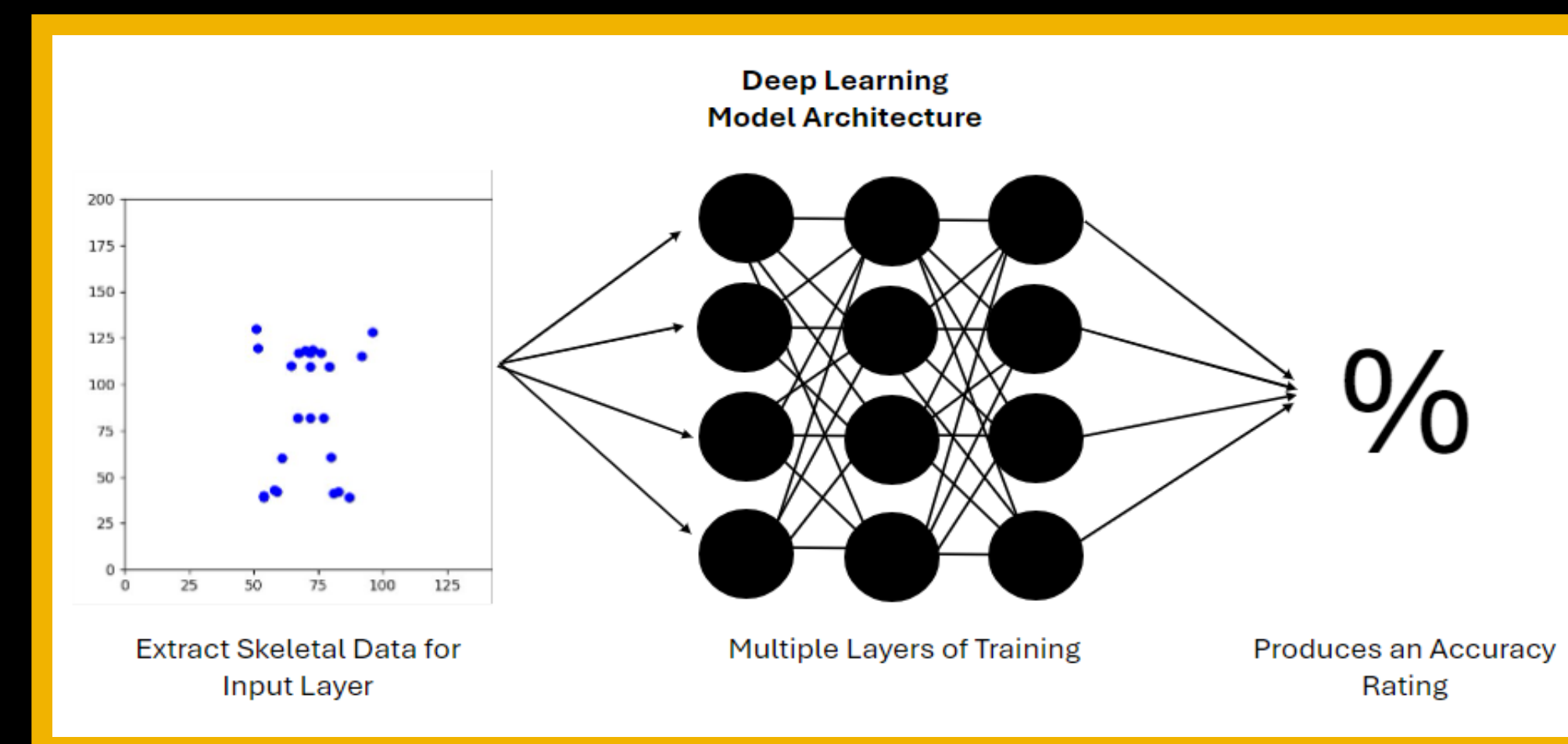
ACKNOWLEDGEMENTS

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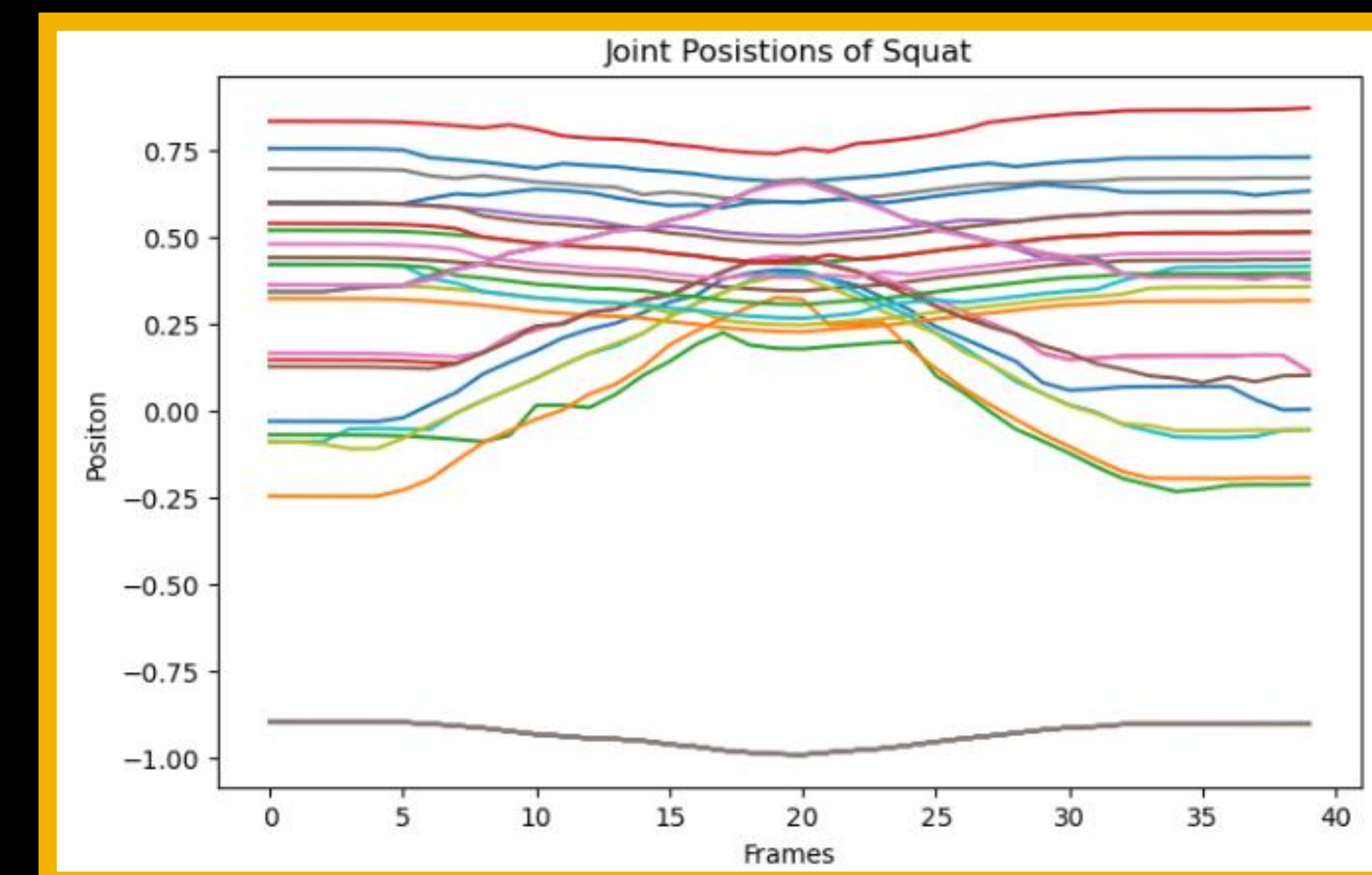
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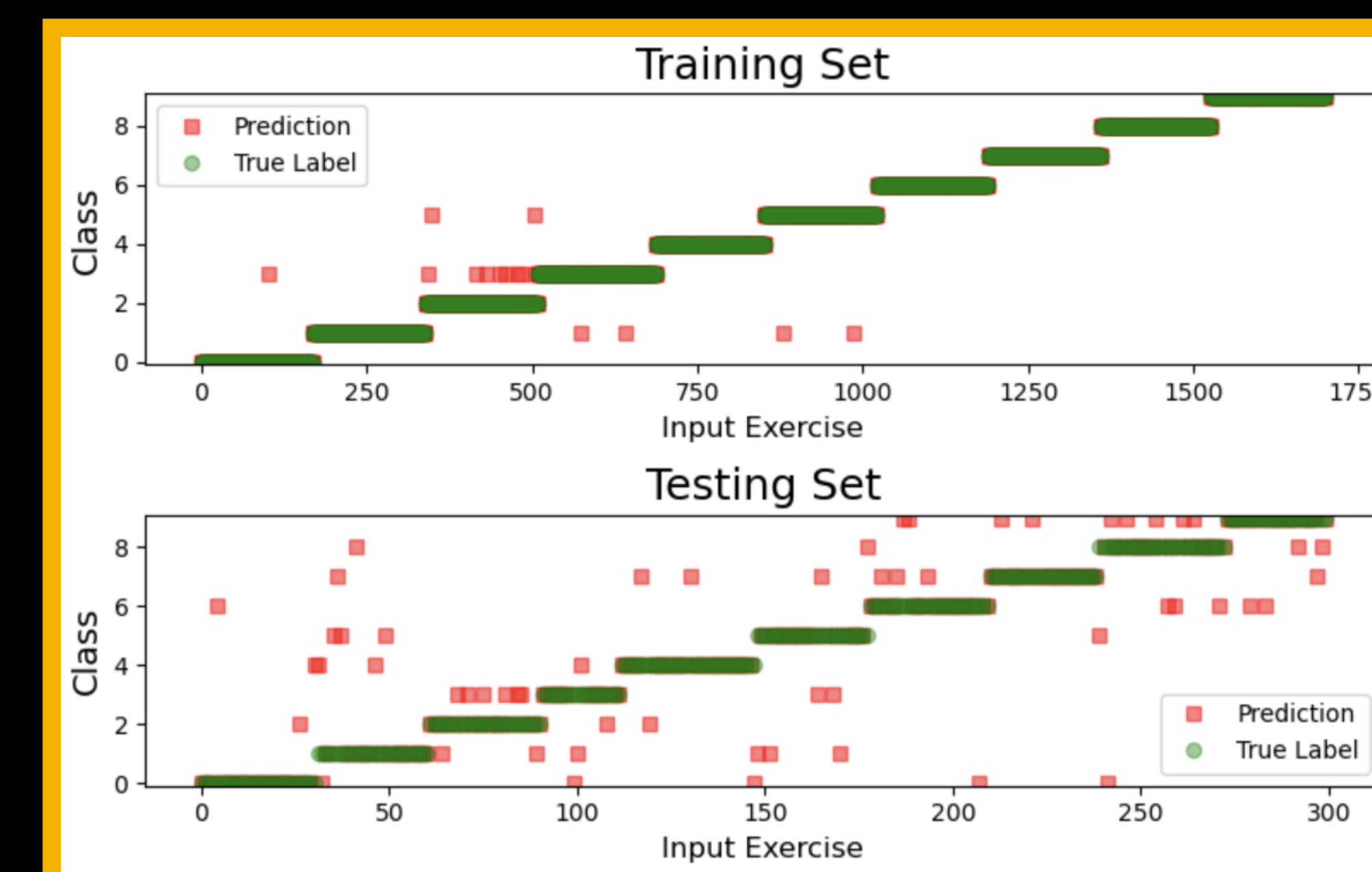
CONCEPT DEVELOPMENT



FINAL DESIGN



Visual representation of a single deep squat used as input. Each line represents the x or y position of a joint over time.



Performance of a recurrent neural network that classifies input as one of 10 selected exercises like squat, lunge, hurdle step, etc.

VALIDATION



Validation of the spatio-temporal model using OpenPose data.



Validation of the spatio-temporal model using Vicon data.

CONCLUSION

- Use a larger database of self-recorded videos for extensive model training and better generalization
- Explore alternative methods of extracting skeletal data

