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Bicyclist Maneuver Type Prediction Using Bidirectional Long Short-Term Memory Neural Networks

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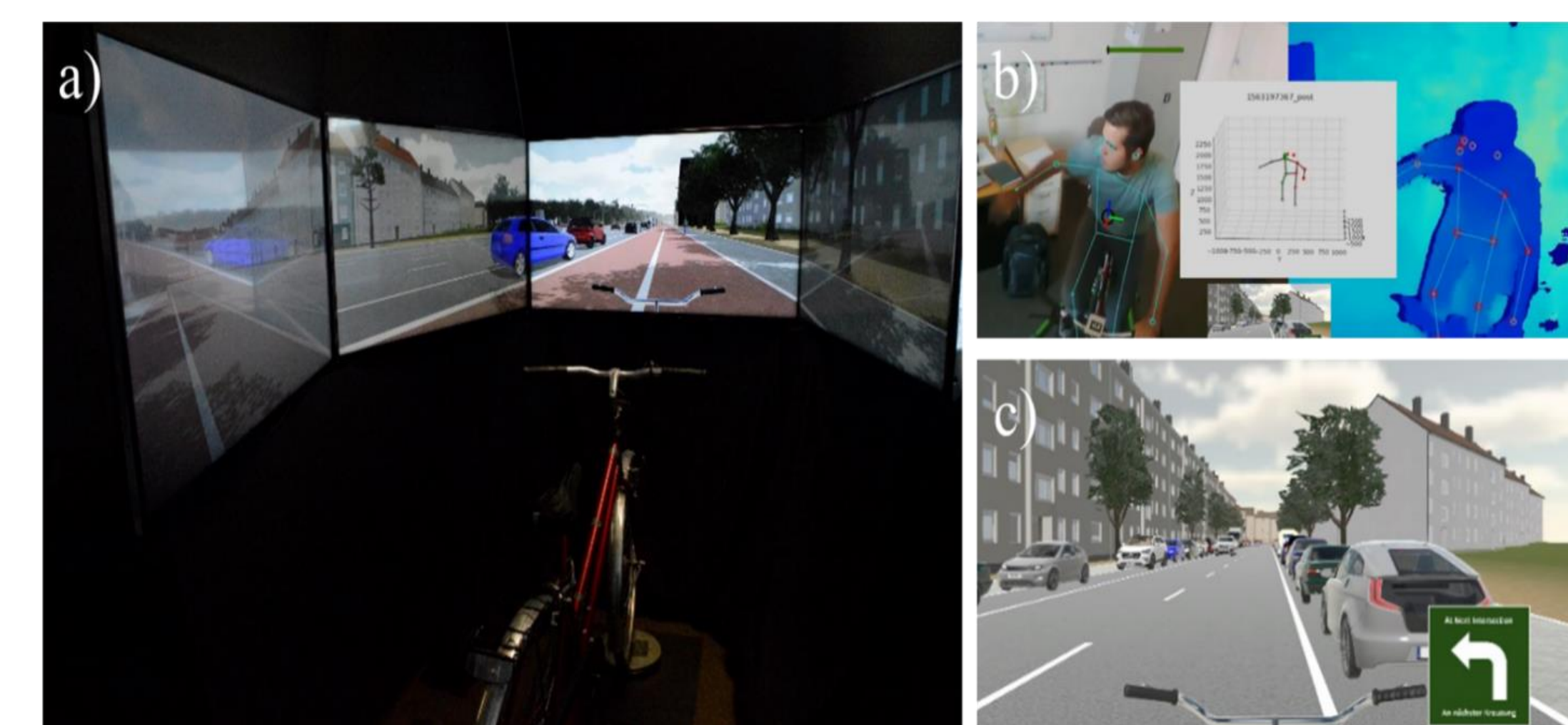
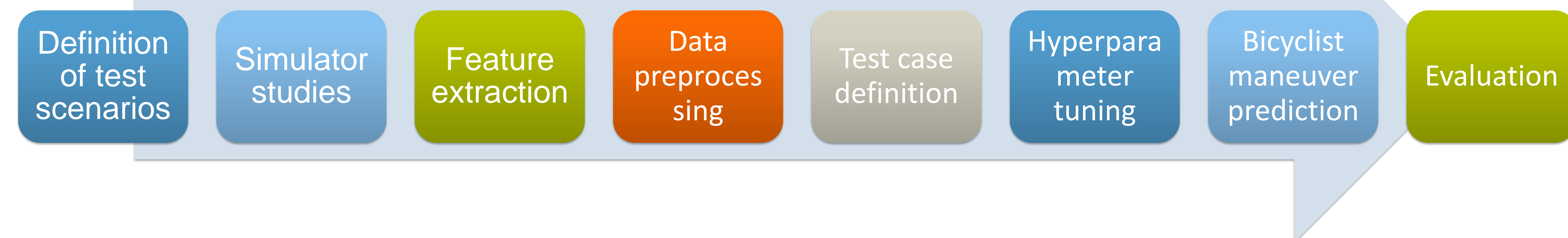
Motivation

- Support autonomous vehicle operation in complex urban road environments.
- Facilitate AV – VRU interaction through the comprehension of human communication behaviour

Objective

- Predict bicyclist maneuver intention by integrating dynamic features of bicyclists with their implicit and explicit communication features

Methodology



a) Bicycle simulator setup, b) skeletal points extraction and depth field detection, c) 3D simulator environment

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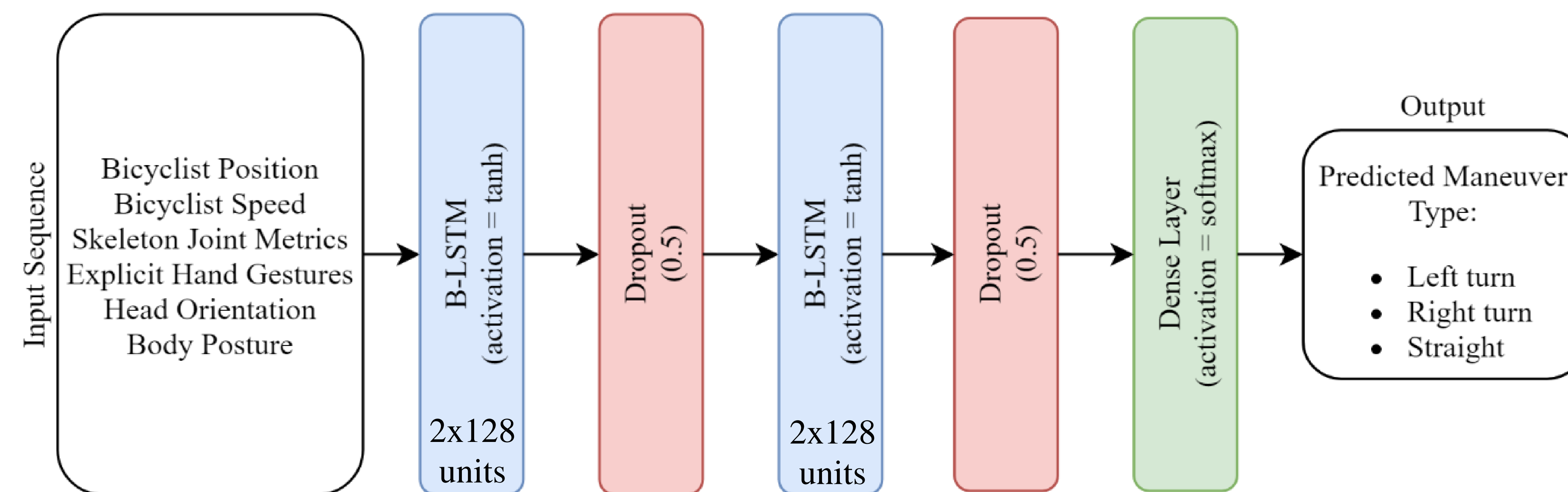


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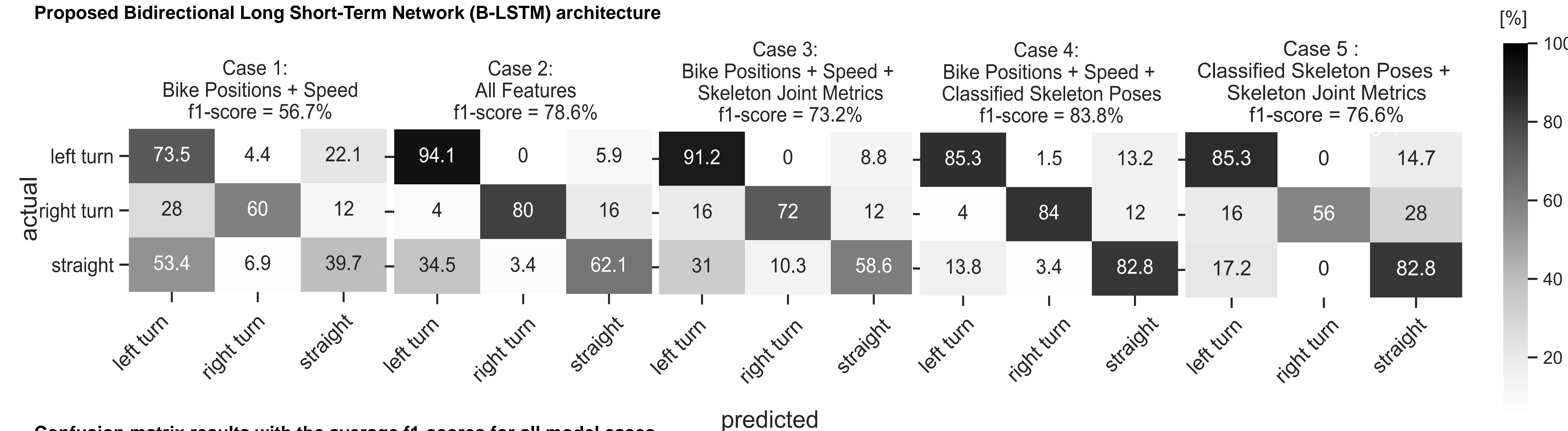
	Description	Scenario	Description	Scenario
Left turn	Test subject is impeded by several vehicles driving straight in the opposite direction and therefore must yield to them and wait to proceed		Test subject is not impeded by any other vehicles	
	Test subject is not impeded by any other vehicles		Test subject is impeded by a vehicle approaching from the right with the right-of-way and therefore must yield to them	
	Test subject must perform a left turn preceded by lane change from right side of approach lane to left side, with a vehicle following behind		Test subject is not impeded by any other vehicles	
Right turn				

Simulator study test scenarios

Results



Proposed Bidirectional Long Short-Term Network (B-LSTM) architecture



Confusion matrix results with the average f1-scores for all model cases

Conclusions

- Results suggest that the best prediction performance is reached with Case 4: Bike Positions + Speed + Classified Skeleton Poses (**f1-score 83,8%**).
- Model Case 4: Bike Positions + Speed + Classified Skeleton Poses demonstrates overall similar accuracy values (>82%) for all maneuver types for the classification task.
- Case 1: Bike Positions + Speed performed the worst compared to all other cases (**f1-score 56,7%**), which illustrates the high added value that the inclusion of bicyclist pose information has in predicting the bicyclist maneuver at the intersection approach.