

“Deep Learning models leverage roles to enhance the motion predictions”

“Roles in THÖR-Magni dataset are powerful cues on future motion”

# THÖR-Magni: Comparative Analysis of Deep Learning Models for Role-conditioned Human Motion Prediction

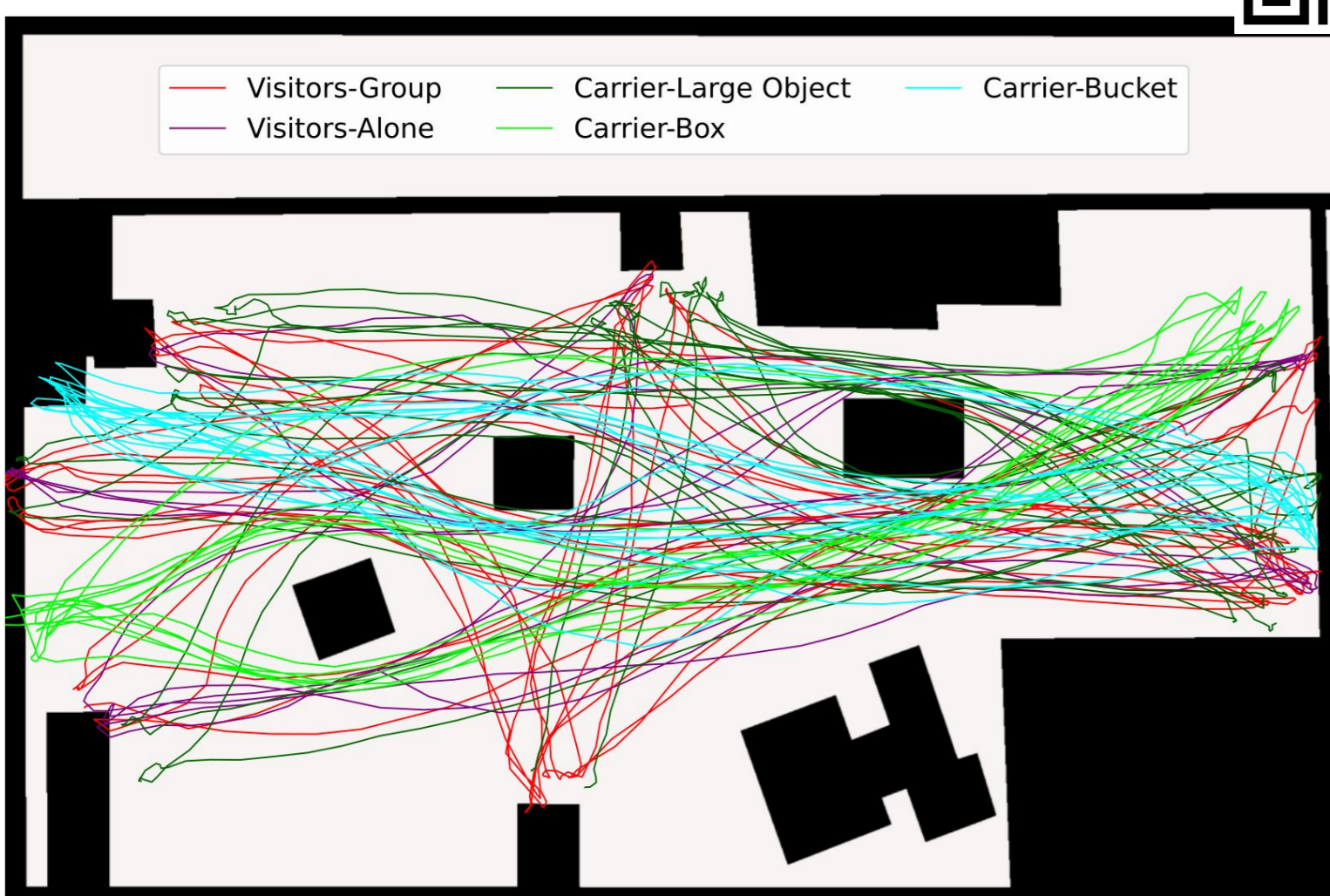
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## Introduction

- THÖR-Magni is a diverse multi-modal dataset of human trajectories
- Roles correspond to various activities or heterogeneous types of agents
- **Role-conditioned Trajectory Prediction:** aims to infer the future state sequence ( $Y_t$ ) from the input ( $X_t$ ), given the class label ( $r_t$ )

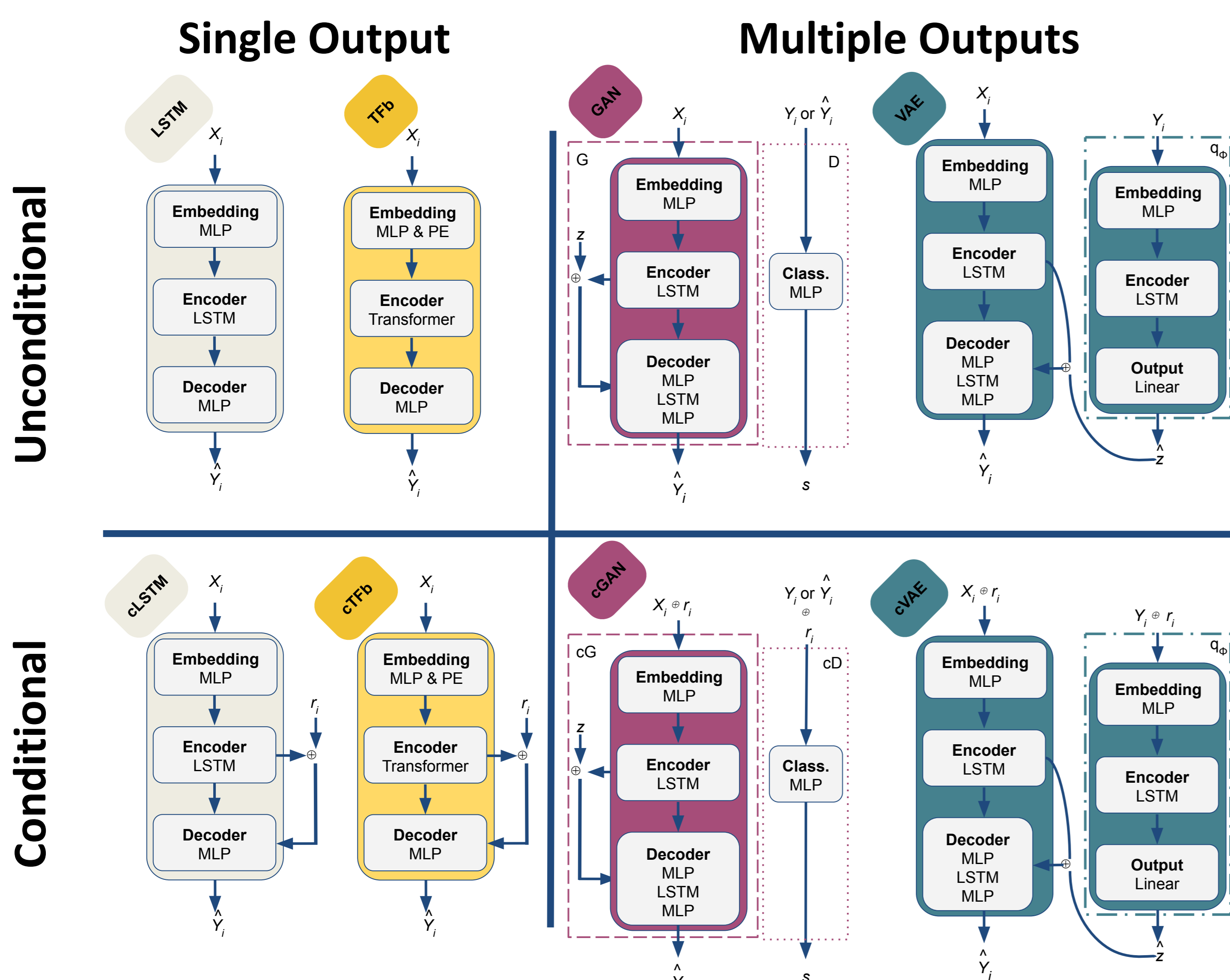
## Methods

### THÖR-Magni dataset



**Accurate:** motion capture recording of social motion  
**Diverse:** moving alone, groups and performing various tasks  
**Multi-modal:** LiDAR point clouds from a moving robot, gaze-tracking data

### Deep Learning models



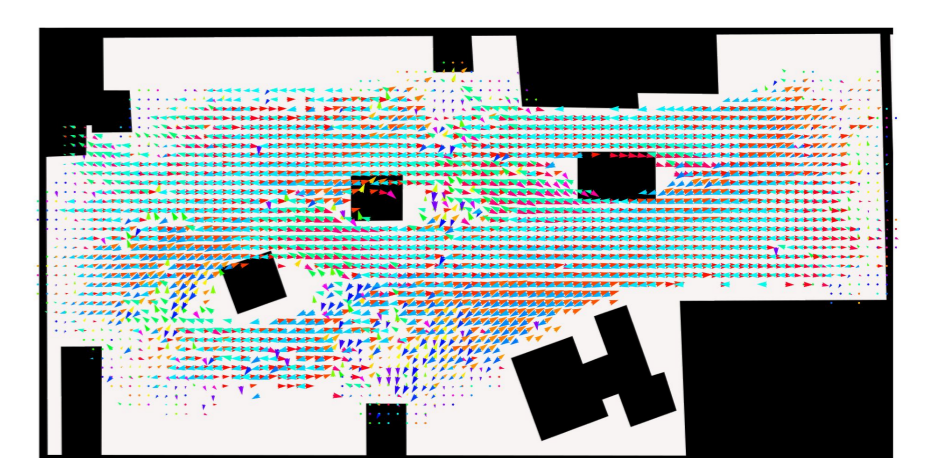
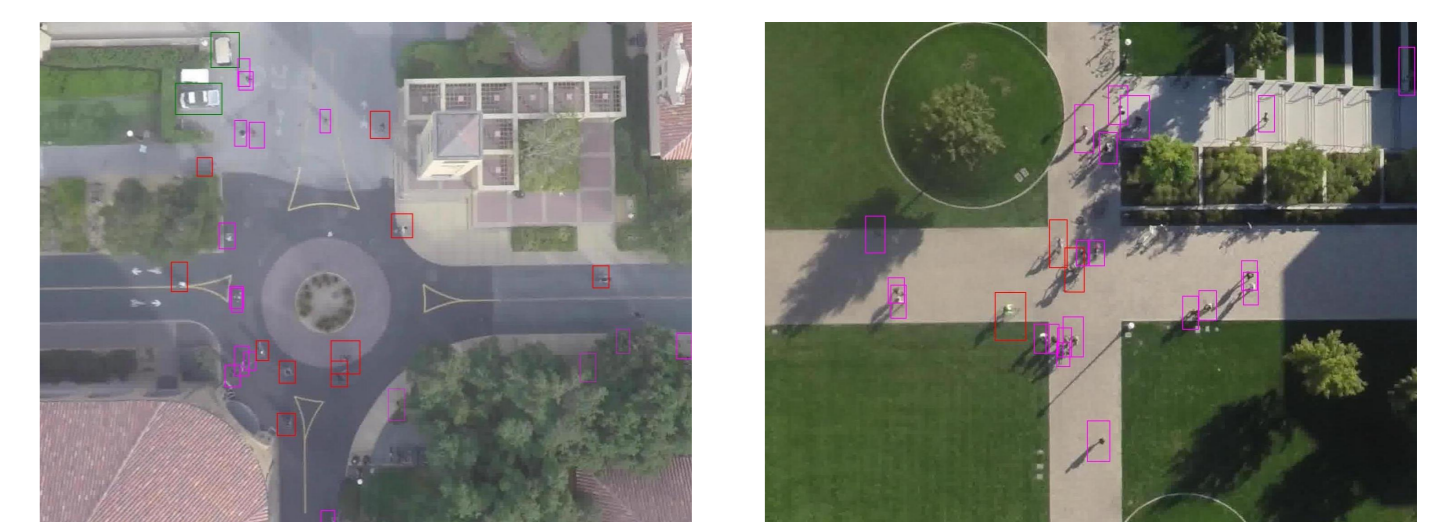
## Results

- Class-conditioned prediction methods **outperform** their class-agnostic counterparts

Methods	Scores	Magni-S2	Magni-S3A	Magni-S3B
LSTM	ADE	0.71±0.05	0.70±0.03	0.73±0.04
	FDE	1.42±0.09	1.41±0.07	1.48±0.08
cLSTM	ADE	<b>0.69±0.05</b>	<b>0.68±0.03</b>	<b>0.72±0.04</b>
	FDE	<b>1.35±0.08</b>	<b>1.35±0.06</b>	<b>1.45±0.07</b>
TFb	ADE	0.72±0.05	0.72±0.03	0.75±0.04
	FDE	1.42±0.09	1.43±0.08	1.50±0.08
cTFb	ADE	<b>0.68±0.06</b>	<b>0.69±0.03</b>	<b>0.73±0.05</b>
	FDE	<b>1.32±0.10</b>	<b>1.37±0.07</b>	<b>1.47±0.07</b>
GAN	ADE	0.68±0.08	0.67±0.04	0.67±0.05
	FDE	1.35±0.15	1.34±0.07	1.36±0.10
	CLL	4.99±0.20	5.24±0.39	5.12±0.33
cGAN	ADE	<b>0.62±0.06</b>	<b>0.62±0.04</b>	<b>0.64±0.04</b>
	FDE	<b>1.23±0.11</b>	<b>1.21±0.10</b>	<b>1.25±0.05</b>
	CLL	<b>4.68±0.28</b>	<b>4.68±0.25</b>	<b>4.92±0.23</b>
VAE	ADE	0.60±0.05	0.62±0.03	0.64±0.04
	FDE	1.19±0.07	1.21±0.08	1.24±0.07
	CLL	4.64±0.27	4.71±0.28	4.95±0.28
cVAE	ADE	0.60±0.04	<b>0.58±0.06</b>	<b>0.63±0.05</b>
	FDE	<b>1.17±0.07</b>	<b>1.15±0.04</b>	<b>1.23±0.08</b>
	CLL	<b>4.51±0.25</b>	<b>4.45±0.28</b>	<b>4.75±0.29</b>

## Future work

- Automated class label inference
- Validation in outdoor scenarios
- Transparent and explainable models for class-conditioned motion



## Further works on trajectory prediction

- Human motion trajectory prediction: a survey
- CLIFF-LHMP: Using Spatial Dynamics Patterns for Long-Term Human Motion Prediction
- Likely, Ligh, and Accurate Context-Free Clusters-based Trajectory Prediction



More questions? Contact me

