

# Asymmetrical Bi-RNNs (U-RNNs), 2nd place solution at the Trajnet++ Challenge for pedestrian trajectory forecasting.

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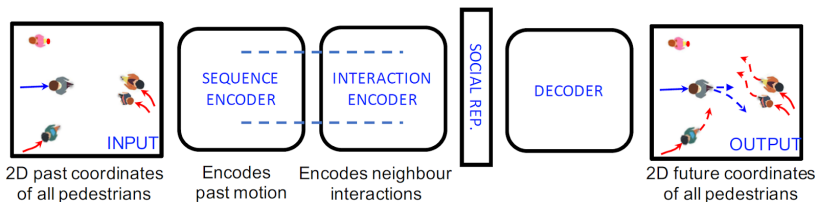
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## Typical pipeline



- Modern approaches specifically focused on the presence of social interactions.
- We focus on the encoding part of the trajectories of individual people.

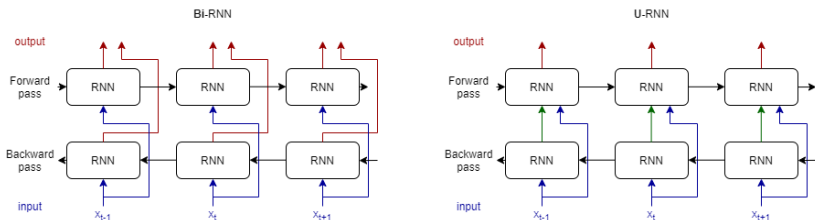
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<sup>1</sup>Kothari *et al.* "Human trajectory forecasting in crowds: A deep learning perspective." (ITS 2021)

<sup>2</sup>Alahi *et al.* "Social lstm: Human trajectory prediction in crowded spaces" (CVPR 2016)

# A better encoder? From RNNs & Bi-RNNs to U-RNNs

The data has a **preferred direction** in time: the forward direction.



→ We accumulate information while knowing which part of the information will be useful in the future.

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<sup>2</sup>Xue *et al.*, "Bi-prediction: pedestrian trajectory prediction based on bidirectional LSTM classification." (DICTA 2017)

<sup>3</sup>Giuliani *et al.* "Transformer networks for trajectory forecasting." (ICPR 2020)

# Results on Trajnet++ real world dataset

Model (Encoder - Decoder)	Interaction	ADE (m)	FDE (m)	Col-I (%)	Col-II (%)
Constant velocity	None	0.68	1.42	14.3	15.2
None - GRU	Dir.	0.63	1.33	6.9	12.1
LSTM - LSTM	Occ.	0.58	1.23	11.5	13.9
<b>U-LSTM - LSTM</b>	Occ.	<b>0.57</b>	<b>1.22</b>	<b>10.2</b>	14.9
GRU - GRU	Dir.	0.58	1.24	6.5	12.4
Bi-GRU - GRU	Dir.	0.585 ± 0.005	1.26 ± 0.01	6.7 ± 0.5	11.7 ± 0.8
U-GRU - GRU	Dir.	0.577 ± 0.008	1.25 ± 0.01	6.5 ± 0.2	11.7 ± 0.5
reversed U-GRU - GRU	Dir.	0.58	1.25	6.5	<b>11.0</b>
LSTM - LSTM	Dir.	0.58	1.25	6.4	11.4
Bi-LSTM - LSTM	Dir.	0.59	1.28	6.2	11.9
<b>U-LSTM - LSTM</b>	Dir.	<b>0.56</b>	<b>1.22</b>	<b>5.2</b>	11.9
reversed U-LSTM - LSTM	Dir.	0.58	1.26	6.6	<b>11.1</b>
LSTM - LSTM	Soc.	0.55	1.18	6.9	12.7
<b>U-LSTM - LSTM</b>	Soc.	<b>0.53</b>	<b>1.15</b>	<b>6.5</b>	11.5
Social NCE [3]	Soc. + contr.	<b>0.53</b>	<b>1.14</b>	<b>5.3</b>	11.3

<sup>3</sup>Liu Yuejiang *et al.* "Social NCE: Contrastive Learning of Socially-aware Motion Representations." (Arxiv 2020)

# Conclusion

- A new sequence encoder.
- Interactions are **NOT** the only aspect on which pedestrian trajectory prediction can progress.
- Could be used to significantly **improve current pedestrian trajectory prediction algorithms.**

—→ <https://github.com/JosephGesnouin/Asymmetrical-Bi-RNNs-to-encode-pedestrian-trajectories>