

Tabular and Time-Series Position Encodings in 6G Network Data

Investigating the Effects on Beam-Prediction Performance and Representation Quality

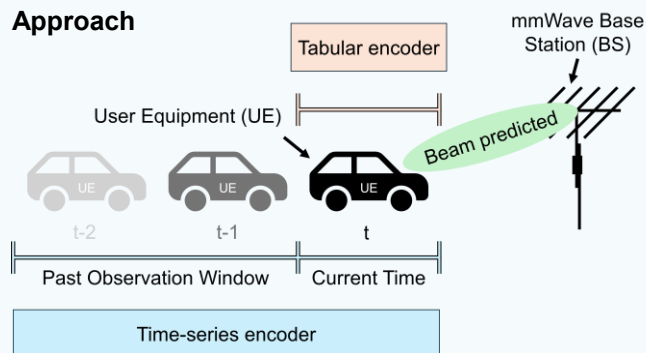
1 Motivation

- Accurate beam prediction improves connection quality while reducing communication overhead.
- Best encoding for 6G beam prediction remains unclear.

2 Research Question

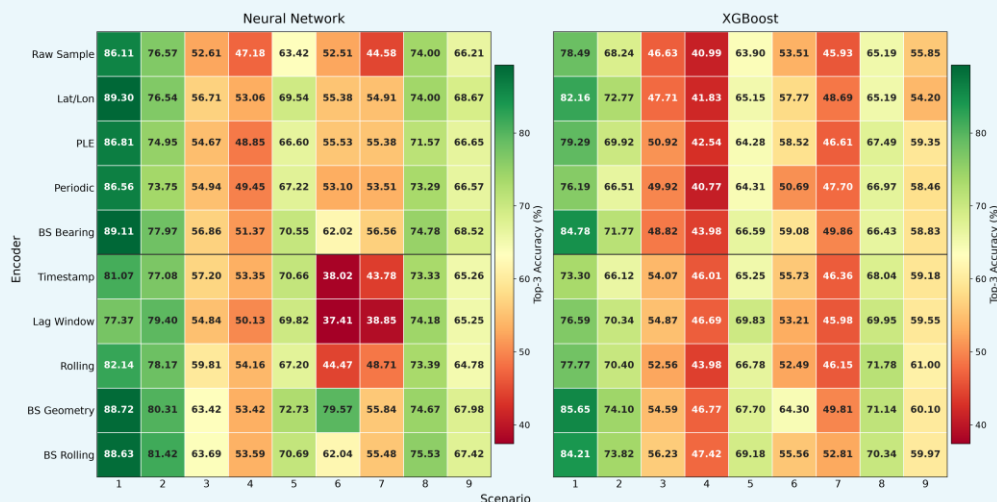
- *How do tabular and time-series position encoding techniques affect beam-prediction performance and feature representation quality in 6G network data?*

3 Approach



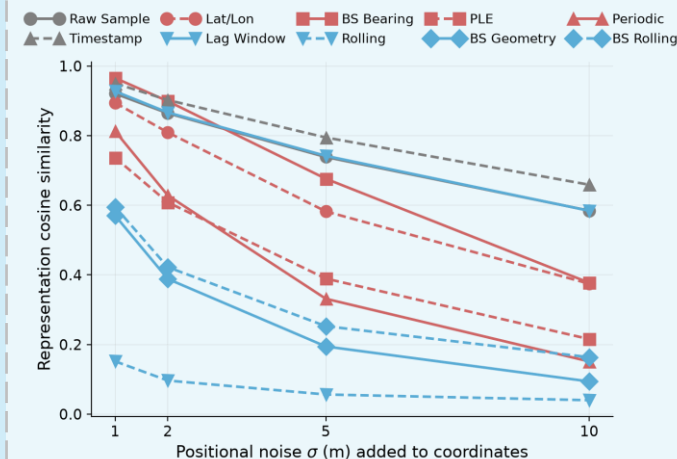
5 Results

How does it affect beam-prediction performance?



- BS-relative encodings perform best in both tracks.
- Raw history or extra dimensionality does not show a significant gain.

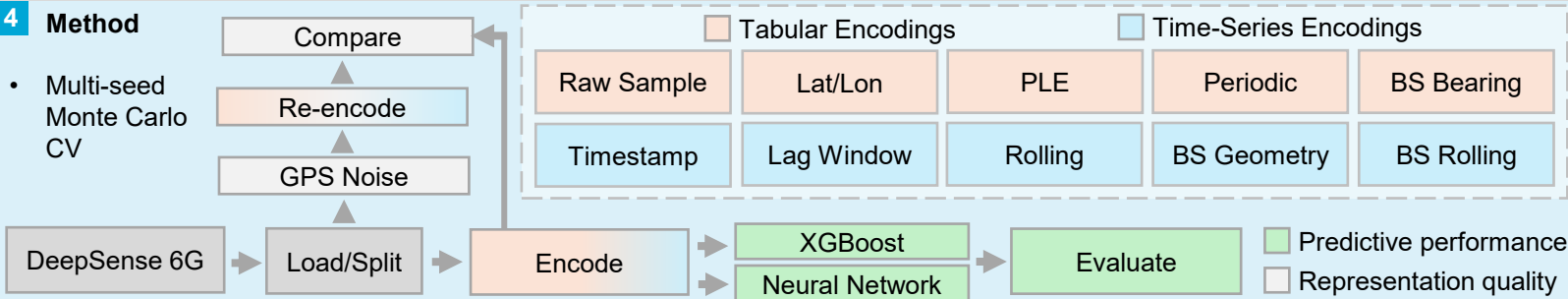
How does it affect feature representation quality?



- Invariance measures representation stability
- Derived BS-relative geometry is less invariant
- Lower invariance does not imply lower accuracy

4 Method

- Multi-seed Monte Carlo CV



6 Key Takeaways

- Encoding is not neutral
- BS-relative encodings have the largest effect
- Temporal context improves prediction
- There is a robustness trade-off

7 Future Work

- Consider other sensing modalities as LiDAR, RADAR and vision
- Test on more 6G datasets
- Robustness-aware encoding design