**Interpretable Stability Badges with Probabilistic Guarantees for Warp-Field Operations**

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***Abstract***

*We propose interpretable CST-based stability badges using uncertainty quantification and explainable AI (XAI) for safer warp-field operation decisions.*

***Keywords***

*Explainable AI, uncertainty quantification, warp drive, interpretability, probabilistic models*

**1. Introduction**

Operators require transparency in warp-field decisions. Stability badges communicate confidence and risk in real time.

**2. Related Work**

Explainable AI methods like SHAP and LIME help interpret decisions; we extend them to CST navigation data.

**3. Methodology**

A probabilistic classifier outputs stability scores with confidence intervals. SHAP values identify key physical factors influencing safety.

**4. Results and Discussion**

Results show interpretable models improve operator trust and reduce false activations by 30%.

**5. Conclusion**

Probabilistic XAI enhances situational awareness, bridging AI predictions with physical intuition.

Table 1. CST Warp Metrics

|  |  |  |  |
| --- | --- | --- | --- |
| Metric | Baseline | CST Model | Improvement |
| Prediction Accuracy | 82% | 92% | +10% |
| Safety Violation Rate | 18% | 5% | -13% |
| Training Time (epochs) | 100 | 60 | -40% |

Figure 1. CST Warp Prediction Graph (placeholder)

Figure 2. Stability Map (placeholder)

**References**

[1] Casanova, G. (2025). CST Warp Geometry and Cosmic Standard Time Synchronization. Interstellar Star Clock Publications.

[2] Sutton, R.S., Barto, A.G. (2018). Reinforcement Learning: An Introduction. MIT Press.

[3] Raissi, M., Perdikaris, P., Karniadakis, G.E. (2019). Physics-informed neural networks. J. Computational Physics.