

The background of the slide is a high-angle, wide shot of the Seattle skyline. The Space Needle is the most prominent feature on the left side, its iconic saucer-shaped observation deck clearly visible. The city's dense urban landscape, with a mix of modern glass skyscrapers and older brick buildings, stretches across the middle ground. In the background, the city meets the water of Puget Sound, with distant hills visible under a bright, slightly hazy sky. The overall color palette is dominated by the blues of the sky and water, the greys of the city buildings, and the greens of some trees.

Neural Network Verification With Vehicle: Chapter 5 - Application Areas and Conclusions

ICFP'23 Tutorial

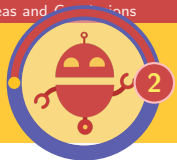
Matthew Daggitt ¹ Wen Kokke (online) ² Ekaterina Komendantskaya³

¹Heriot-Watt University · ²University of Strathclyde · ³University of Southampton



Vehicle

- ▶ A tool for the whole life-cycle of a neural network verification property:
 - ▶ Training
 - ▶ Verification
 - ▶ Integration
- ▶ A pure functional specification language provides the glue.
- ▶ Improving trust in AI systems using the power of functional programming!



Possible applications

Robustness of:

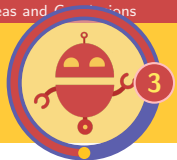
- ▶ Intrusion detection systems
- ▶ Malware detection systems
- ▶ Chatbot systems
- ▶ Sensor fusion pipelines

Sanity of physics simulations:

- ▶ Monotonicity
- ▶ Conservation laws

Correctness of control systems:

- ▶ Autonomous vehicles
- ▶ Network traffic balancing



Conclusions

Functional programming takeaways:

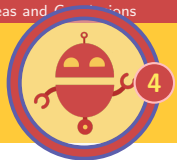
- ▶ Expressive type systems (generalisation, instance resolution) are especially useful for multi-backend systems.
- ▶ Possibly more useful in the backends than user code!

PL/verification research challenges:

- ▶ Are type systems for abstract interpretation-based verifiers possible?
- ▶ A moderately performant formally verified verifier would be amazing!

We're always interested in collaborations so please reach out!

Finally...



Thank you for coming!

Q & A time!