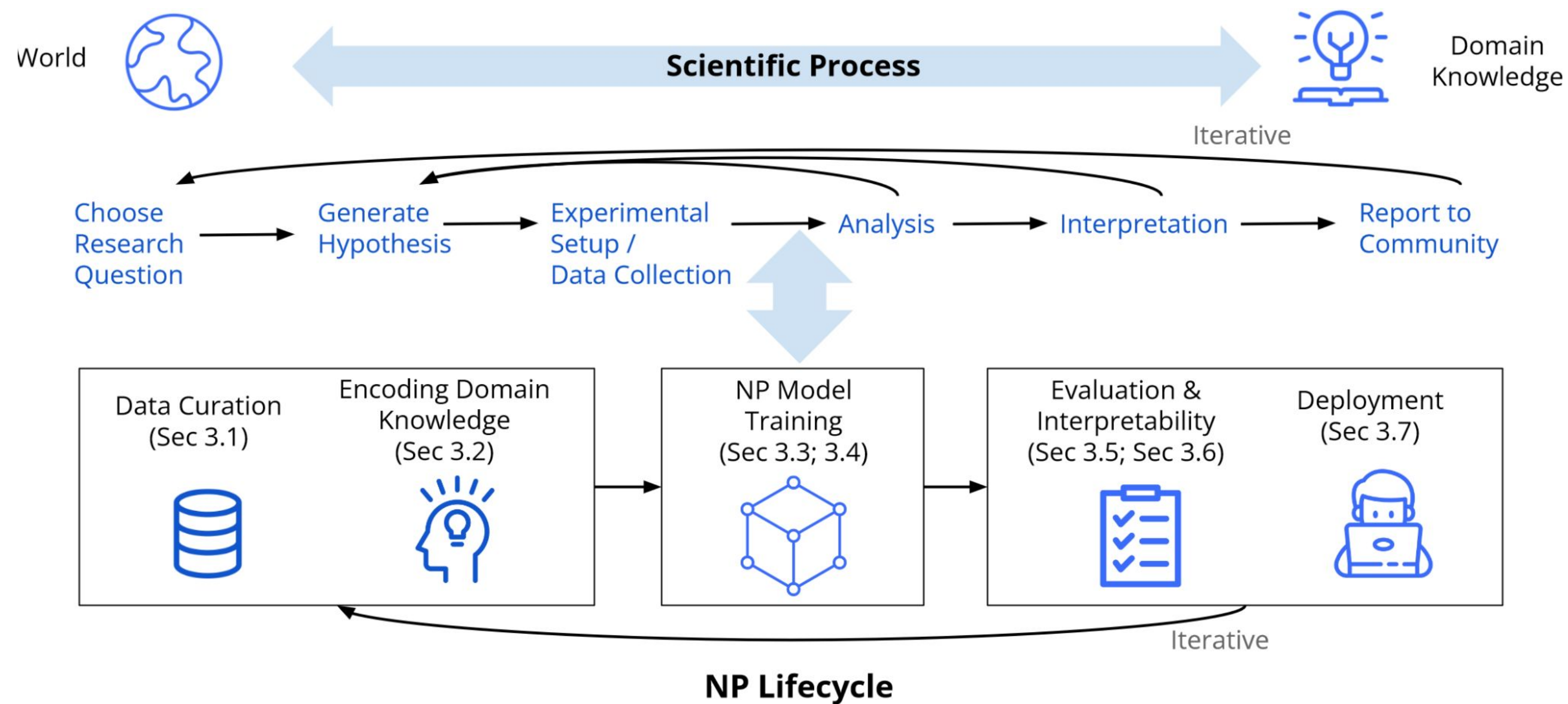


Neurosymbolic Programming for Science

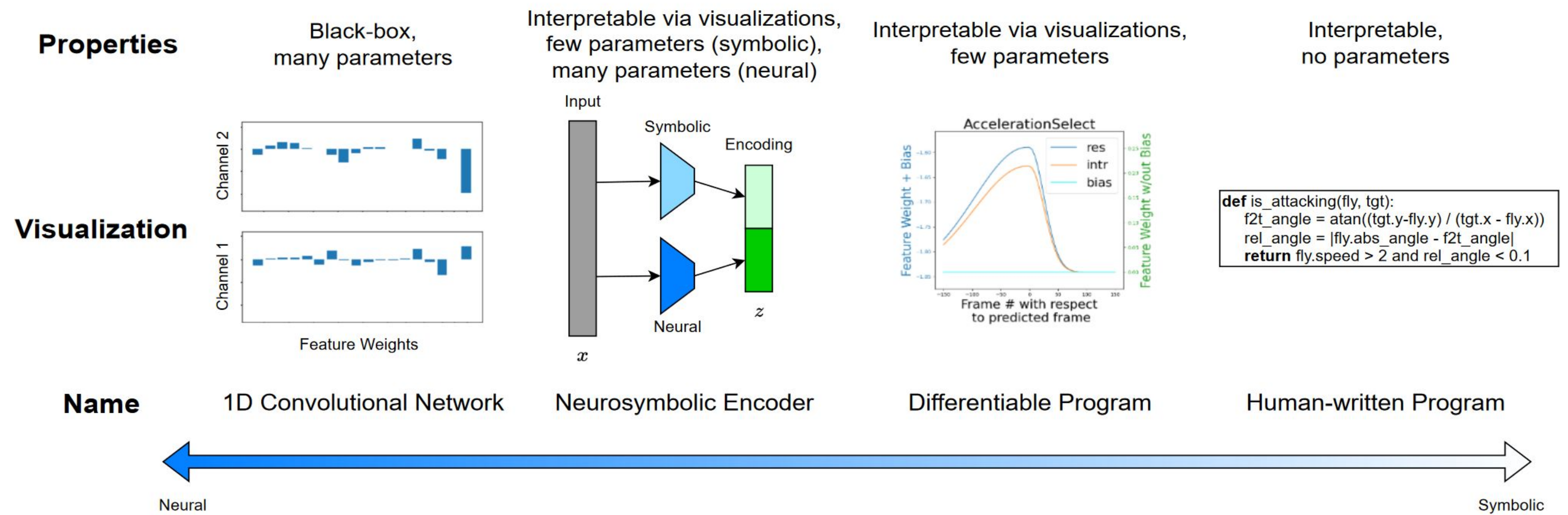
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Armando Solar-Lezama², Swarat Chaudhuri³, Yisong Yue¹, Omar Costilla Reyes²
¹Caltech ²MIT CSAIL ³UT Austin



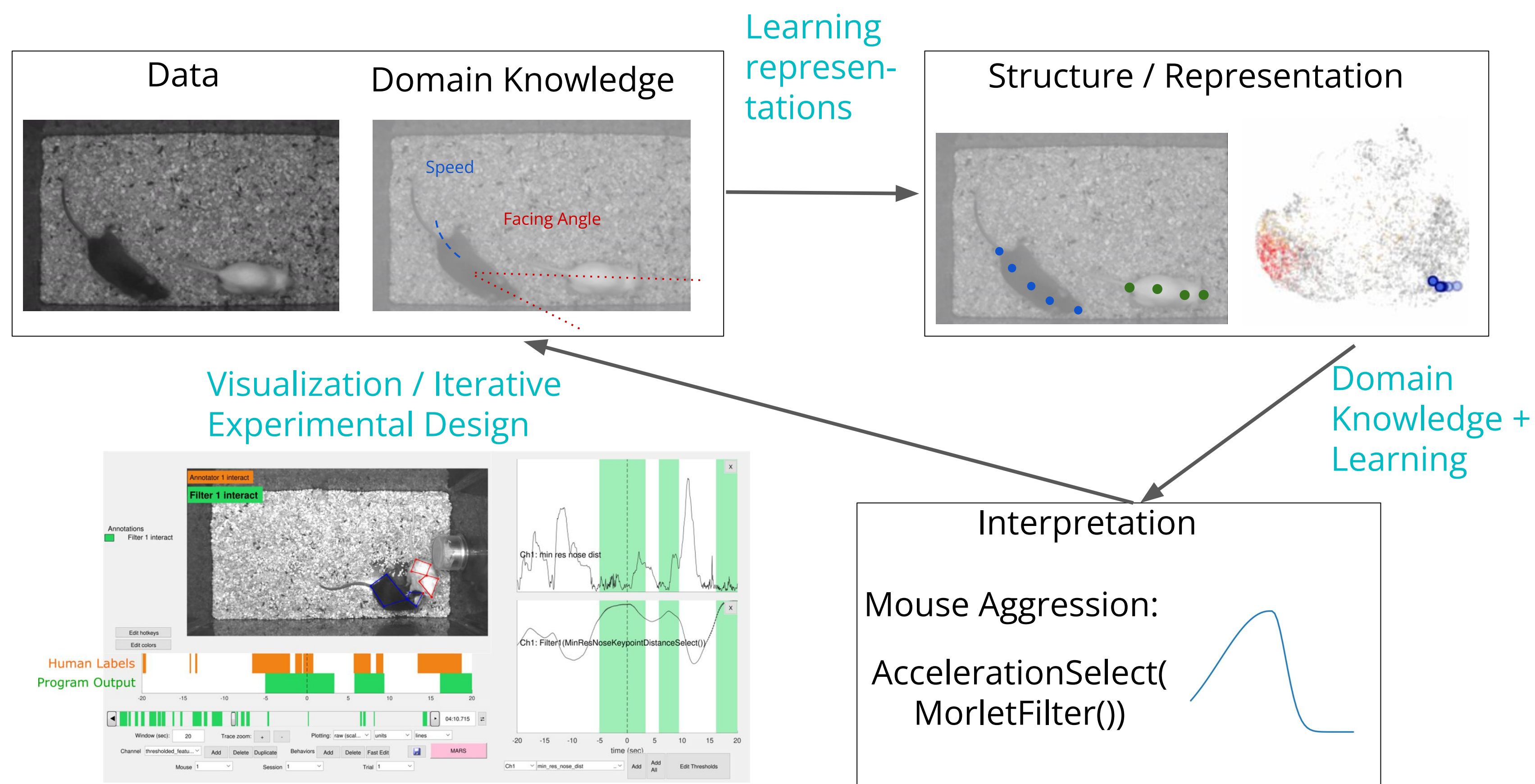
Neurosymbolic Programming combine neural and symbolic components to learn complex patterns and representations from data, using high-level concepts or known constraints.



Neurosymbolic Programming Techniques



Concrete Examples in Behavior Analysis



MARS: <https://github.com/neuroethology/MARS>

- **Greater data efficiency**
 - Task Programming (CVPR 2021) *Awarded Best Student Paper at CVPR*
 - AutoSWAP (CVPR 2022): automatically synthesizing weak supervision
 - Self-supervised keypoint discovery from behavioral videos (CVPR 2022)
- **Interpretability**
 - Neural Admissible Relaxation (NeurIPS 2020): program synthesis
 - Interpreting Expert Annotation Differences (CV4Animals 2021)
 - Neurosymbolic Encoders (TMLR 2022): discover clusters programmatically

Takeaways:

Opportunities and Challenges

- Scalability
- Encoding Domain Knowledge
- Discrete and Continuous Optimizations
- Dealing with imperfect datasets
- Cross-domain benchmarks and cross-domain tools
- Evaluating interpretability