

The EASY-AI Symbology

Alexis L. Ellis^{1,*}, Cogan Shimizu¹

¹Wright State University

Abstract

As artificial intelligence (AI) surges into the forefront of research and the lives of everyday people, challenges in understanding and communicating how these systems operate are becoming more prevalent. The need for a common language for AI systems that allows for multidisciplinary understanding and communication is a prevalent topic within the field. In this work, we take the visual framework EASY-AI and create a symbolic system that overlays the framework's ontology to facilitate such communication and understanding. **Poster submission.**

Keywords

Explainable AI, Human Machine Interaction, Human Factors Engineering, Symbology, Education

1. Introduction

As artificial intelligence (AI) moves into the spotlight of not only major research interests but also its rapid implementation into our daily lives, challenges in understanding and communicating these systems are becoming more prevalent. These challenges will only increase in complexity as advancements in the state-of-the-art [1] continue to evolve. Therefore, constructing a common language that can facilitate inclusive collaboration of all AI users, a fundamental understanding of systems, and a means of explainability is becoming necessary. There are many ways we can attempt to tackle the interpretability, communication, and explainability of AI, however, one way is through a visual framework that utilizes symbols to represent these AI systems. The utilization of symbols to convey information is not a new idea, with the use of symbols being traced back from our earlier recorded history [2] to our present-day use of symbols in the form of emojis, capable of conveying entire thoughts and feelings [3]. Through a visual framework that utilizes symbols, we can break down AI systems ranging from the simplest systems to the higher complexities we will encounter in the future. Our work of sEmantic And compoSable gLYphs to represent artificial intelligence systems (EASY-AI) [4] aims to provide such a framework, combining ontology which facilitates in-depth understanding and a symbolic-driven visual component that creates a more digestible representation of AI systems.


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*Cogan Shimizu.

✉ ellis.177@wright.edu (A. L. Ellis); cogan.shimizu@wright.edu (C. Shimizu)

🆔 0009-0000-8098-4262 (A. L. Ellis); 0000-0003-4283-8701 (C. Shimizu)

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2. Related Work

Work to develop a visual framework that represents and provides explainability, multidisciplinary collaboration, and transparency to AI is starting to surface in the field, with work like *The Boxology* framework [5]. The boxology framework takes a broad approach using various simple geometric shapes to represent parts of an AI system and its algorithms and arrows to indicate the flow of data from one component to another. The work conducted in our framework EASY-AI extends boxology by providing a deeper level of explainability with the implementation of an underlying ontology. Initially, the ontology would provide standardization and constraints to how the shapes in the boxology could interact using axioms derived from [6, 7] which can be seen in the top right corner of figure 2. However, the issue in the organization and presentation of systems became apparent when looking to fit the EASY-AI framework on a complex system using only the boxology as the visual representation. Therefore, we have extended EASY-AI by creating a symbology that can condense the visual representation of simple and complex systems to aid in overcoming this challenge.

3. The EASY-AI Glyphs

The symbology of EASY-AI is inspired by the drag-and-drop symbolic widget interface of the Orange Data Mining tool [8]. EASY-AI's symbolic widgets will represent the different instances of data, processes, and models that the boxology framework distinguishes, but these new symbols can connect and collapse to lower the visual load of the user to reduce the chances of inattentive blindness which a high visual load can cause [9]. Represented in Figure 1 is each of the symbols that will be used in the next section 3.1 with a Use Case. Beginning at the top left and moving right we have the input-type-data, process-type-train, model-type-statistical, and process-type-deduce. Moving down to the next row starting from the left side, moving right is model-type-semantic, process-type-reinforced-learning, input-type-symbol, and output.



Figure 1: The EASY-AI Glyphs.

3.1. Use Case

To demonstrate how the glyphs from figure 1 work in the framework we have applied them to the Roomba use case [10] which originally utilized the initial EASY-AI framework with the boxology as the visual component depicted in the bottom right of figure 2. The Roomba use case is not a very complex system to represent, however, from this visualization, it would not be difficult to imagine how chaotic and confusing this framework can be if it were to attempt to represent a highly complex AI system. This initial layer would be considered the foundational layer where we have a more technical representation of AI systems. Using the new symbology, we swapped the boxology representations of the Roomba as seen in the bottom depiction in

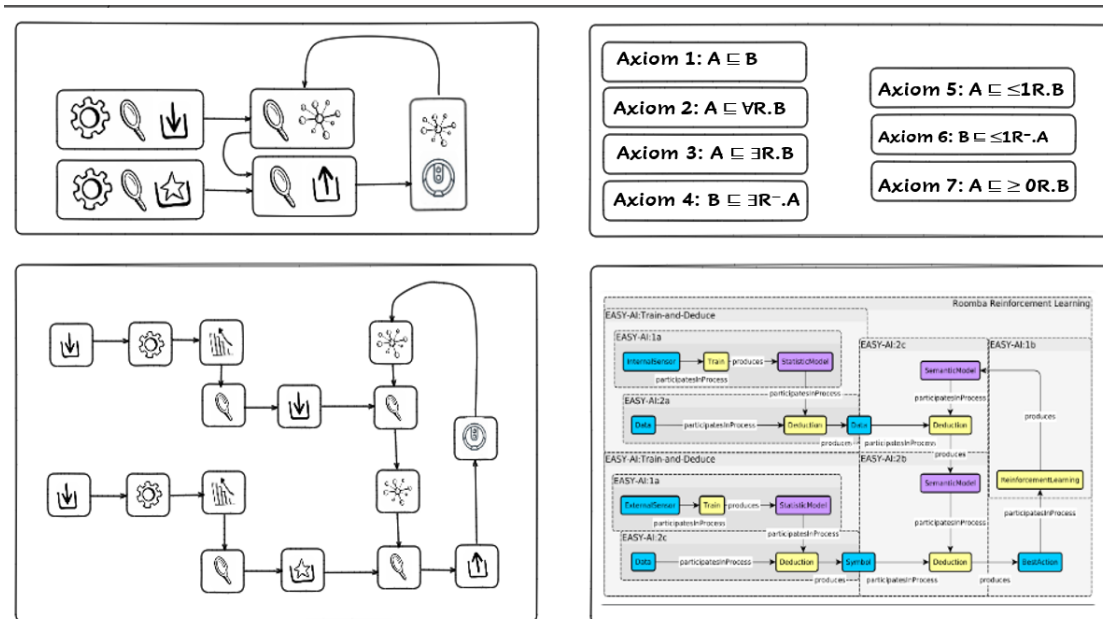


Figure 2: The EASY-AI Roomba Use Case

figure 2 to the symbology reconstruction on the bottom left of figure 2. To compose the amount of visual information that the user ingests, the framework can then be collapsed if necessary, as demonstrated in the top left depiction in figure 2. The framework is meant to be able to expand or collapse as the user’s needs vary as well as how in-depth they wish to understand the system.

4. Conclusion

With the rapid advancements in artificial intelligence (AI) a way to explain, understand, and communicate these systems is becoming a prevalent challenge not only between domain experts but also to casual users. The EASY-AI framework is set to overcome these challenges by providing a common language. Paired with EASY-AI’s underlying ontology for explainability, we have now provided a simplistic and easily digestible way to communicate systems to one another by adapting a symbology to the EASY-AI framework. While these symbols have not undergone user testing, we hope to conduct such testing in the near future. Additionally, we will implement the symbolic nesting for SNOOP-AI [11] in CoModIDE [12].

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References

- [1] A. Teije, F. Harmelen, Chapter 3. Architectural Patterns for Neuro-Symbolic AI, 2023. doi:10.3233/FAIA230135.
- [2] C. Mühlenbeck, T. Jacobsen, On the origin of visual symbols., *Journal of Comparative Psychology* 134 (2020) 435–452. URL: <https://doi.apa.org/doi/10.1037/com0000229>. doi:10.1037/com0000229.
- [3] M. A. Riordan, Emojis as Tools for Emotion Work: Communicating Affect in Text Messages, *Journal of Language and Social Psychology* 36 (2017) 549–567. URL: <https://doi.org/10.1177/0261927X17704238>. doi:10.1177/0261927X17704238, publisher: SAGE Publications Inc.
- [4] A. Ellis, B. Dave, H. Salehi, S. Ganapathy, C. Shimizu, Semantic and composable glyphs to represent ai systems, *Hybrid Human Artificial Intelligence*, 2024.
- [5] M. van Bekkum, M. de Boer, F. van Harmelen, A. Meyer-Vitali, A. t. Teije, Modular design patterns for hybrid learning and reasoning systems: a taxonomy, patterns and use cases, *Applied Intelligence* 51 (2021) 6528–6546. Publisher: Springer.
- [6] A. Eberhart, C. Shimizu, S. Chowdhury, M. K. Sarker, P. Hitzler, Expressibility of OWL Axioms with Patterns, in: R. Verborgh, K. Hose, H. Paulheim, P.-A. Champin, M. Maleshkova, O. Corcho, P. Ristoski, M. Alam (Eds.), *The Semantic Web*, volume 12731, Springer International Publishing, Cham, 2021, pp. 230–245. URL: https://link.springer.com/10.1007/978-3-030-77385-4_14. doi:10.1007/978-3-030-77385-4_14, series Title: Lecture Notes in Computer Science.
- [7] C. Shimizu, P. Hitzler, Q. Hirt, D. Rehberger, S. G. Estrecha, C. Foley, A. M. Sheill, W. Hawthorne, J. Mixter, E. Watrall, The enslaved ontology: Peoples of the historic slave trade, *Journal of Web Semantics* 63 (2020) 100567. URL: https://www.sciencedirect.com/science/article/pii/S1570826820300135?casa_token=MKa6y-Eap20AAAAA:qoFPakBVQ4glQq40GtKjS_C6LlkouPxxg6aL1hLVfPokAF5IapNRu_mwpehhv6pUZqYodG1B5, publisher: Elsevier.
- [8] B. L. University of Ljubljana, Orange data mining - data mining fruitful & fun, <https://orangedatamining.com/>, 2023. Version 3.33.0.
- [9] C. M. Greene, G. Murphy, J. Januszewski, Under High Perceptual Load, Observers Look but Do Not See, *Applied Cognitive Psychology* 31 (2017) 431–437. URL: <https://onlinelibrary.wiley.com/doi/abs/10.1002/acp.3335>. doi:10.1002/acp.3335, _eprint: <https://onlinelibrary.wiley.com/doi/pdf/10.1002/acp.3335>.
- [10] T. D. Hawkes, T. J. Bihl, Symbols to represent AI systems, in: *NAECON 2021 - IEEE National Aerospace and Electronics Conference*, IEEE, Dayton, OH, USA, 2021, pp. 61–68. URL: <https://ieeexplore.ieee.org/document/9696419/>. doi:10.1109/NAECON49338.2021.9696419.
- [11] A. Ellis, B. Dave, H. Salehi, S. Ganapathy, C. Shimizu, Implementing snoop-ai in comode, *National Aerospace and Electronics Conference*, 2024.
- [12] C. Shimizu, K. Hammar, Comode—the comprehensive modular ontology engineering ide, in: *ISWC 2019 Satellite Tracks (Posters & Demonstrations, Industry, and Outrageous Ideas) co-located with 18th International Semantic Web Conference (ISWC 2019) Auckland*, New Zealand, October 26–30, 2019., volume 2456, CEUR-WS, 2019, pp. 249–252. URL: <https://www.diva-portal.org/smash/get/diva2:1355737/FULLTEXT01.pdf>.