

Interdisciplinarity of Applied Machine Learning in STEM Education

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What is Machine Learning?

- Large dataset
- **Informative feature**
- Pattern
- Prediction

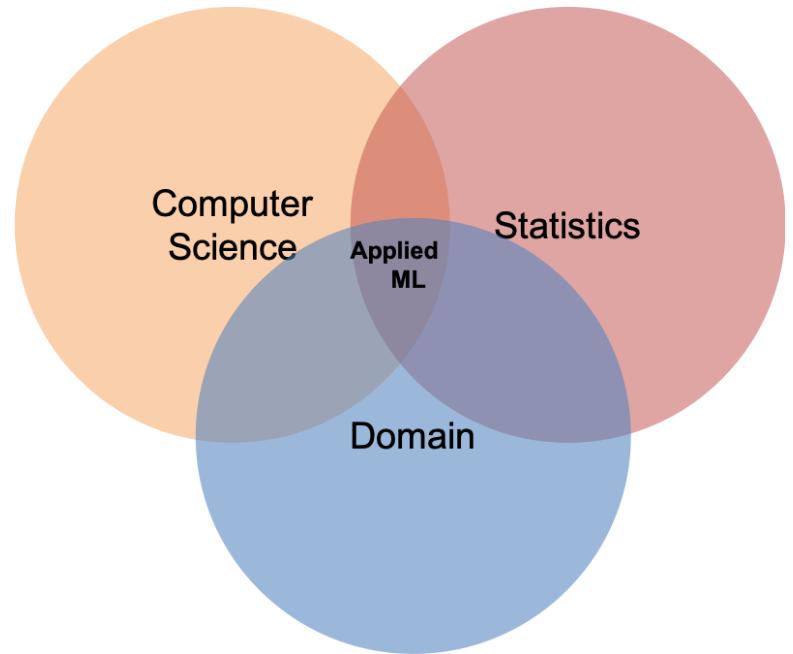
Chihuahua or Muffin?



Source: www.freecodecamp.org

Machine Learning is about
automatically finding meaningful
patterns in data

Interdisciplinarity



Interdisciplinarity

Multimodal Trajectory Analysis of Visitor Engagement with Interactive Science Museum Exhibits

Authors Andrew Emerson, Nathan Henderson, Wookhee Min, Jonathan Rowe, James Minogue, James Lester

Computer scientist

Educational researcher

Outline

- Overview
- Affordances
- Limitations

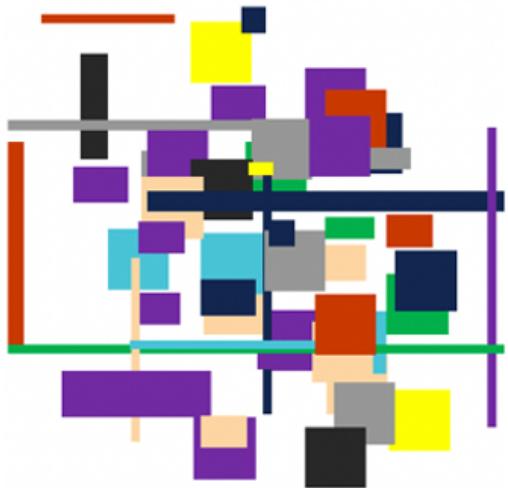
Overview: Literature Review

- Journal of Science Education and Technology Special Issue (2021) Applying ML in Science Assessment
- Alonso-Fernández et al. (2019) reviewed the literature for applications to game learning analytics (GLA) data
- Luan & Tsai (2021) reviewed the literature for applications of ML for precision education
- Bergner & von Davier (2019) reviewed NAEP's use of learning process data

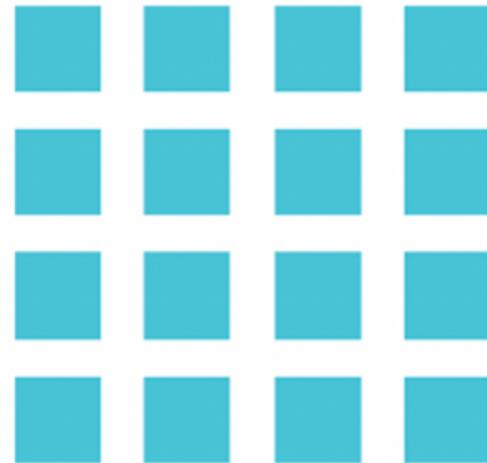
Overview: ML Techniques

- Unsupervised learning:
 - Augmented Reality in Science Laboratories: Investigating High School Students' **Navigation Patterns** and Their Effects on Learning Performance (Jiang et al., 2021)
- Supervised learning:
 - Predicting **STEM and Non-STEM College Major Enrollment** from Middle School Interaction with Mathematics Educational Software (San Pedro et al., 2014)

Overview: ML for K-12



Unstructured data
Data is messy and disconnected



Structured data



Project StoryQ



Affordances of Machine Learning

- **Students:** e.g., customizable experiences
- **Teachers:** e.g., automated scoring
- **Researchers:** e.g., analyze patterns in data

Limitations of Machine Learning

- Ethical considerations
- Deterministic problems
- Lack of (good) data
- Interpretability
- Learning in context

Machine Learning is a current hot topic and continues to grow in popularity based on its applications