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# An Information Theoretic Approach to Novel Shape Identification, Matching and Classification COPYRIGHT

Novel Shape Identification, Matching and Classification for Artificial Intelligence and Robotics

SI Case #M17-185P

## Background

The fields of robotics and artificial intelligence (AI) have rapidly expanded over the last decade. Robots have become more complex and cost effective while machine learning has improved the mechanisms by which computers can identify images, languages, or shapes. The combination of these technologies has the potential to revolutionize interstellar and terrestrial exploration. Robots, guided by artificial intelligence, could collect samples from distant celestial bodies or under deep seas where communication is impossible. The ideal expedition robot could independently search for, identify, and classify objects of interest. However, sufficiently adaptable AI have not yet been integrated into robotics to realize this dream. A flexible and systematic AI which allows robots to explore an environment independently would be a good first step in this endeavor.

## Invention Description

Researchers at ASU have developed an AI which identifies and classifies objects of interest. This method utilizes the SuperFormula-based machine learning algorithm to determine if an object is relevant. This algorithm has been shown to be able to identify a range of objects and account for irregularities. Unlike less adaptable methods, this method does not rely on a library of predetermined objects to make decisions, but rather the AI inherently has the ability to detect interesting objects regardless of shape. This means that a large library of predicted objects is not necessary, thus the program can identify interesting objects that might not have been predicted, making this AI far more powerful. Utilization of this technique may allow robots to independently identify objects of interest, enabling autonomous robots to explore terrestrial zones or celestial bodies which are currently unreachable or may have harsh environmental conditions. Possible applications range from treasure hunting to searching for alien-life.

#### Potential Applications

- Identification of Objects and Extrapolation to new shapes
- Identification of Intelligent Beings
- Planetary Robotics
- Robotic Sample Retrieval
- Meteor Detection

#### Benefits and Advantages

- Flexible - The SuperFormula-guided AI allows the program to detect interesting objects regardless of shape
- Enabling – greatly enhances robotic capabilities and functionality
- Simple – algorithms have simplified design
- Adaptable – ported onto low cost hardware such as FPGs and DSP devices

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