



Thesis Defense

Computer Science Master's Program

“Anomaly Detection in Heterogeneous IoT Systems: Leveraging Symbolic Encoding of Performance Metrics for Anomaly Classification”

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Abstract:

Anomaly detection in Internet of Things (IoT) systems has become an increasingly popular field of research as the number of IoT devices proliferate year over year. Recent research often relies on machine learning algorithms to classify sensor readings directly. However, this approach leads to solutions being non-portable and unable to be applied to varying IoT platform infrastructure, as they are trained with sensor data specific to one configuration. Moreover, sensors generate varying amounts of non-standard data which complicates model training and limits generalization. This research focuses on addressing these problems in three ways a) the creation of an IoT Testbed which is configurable and parameterizable for dataset generation, b) the usage of system performance metrics as the dataset for training the anomaly classifier which ensures a fixed dataset size, and c) the application of Symbolic Aggregate Approximation (SAX) to encode patterns in system performance metrics which allows our trained Long Short-Term Memory (LSTM) model to classify anomalies agnostic to the underlying system configuration. Our devised IoT Testbed provides a lightweight setup for data generation which directly reflects some of the most pertinent components of Industry 4.0 pipelines including a MQTT Broker, Apache Kafka, and Apache Cassandra. Additionally, our proposed solution provides improved portability over state-of-the-art models while standardizing the required training data. Results demonstrate the effectiveness of utilizing symbolized performance metrics as we were able to achieve accuracies of 96.03%, 87.33%, and 87.47% for three different IoT system configurations. The latter two accuracies represent the model's ability to be generalized to datasets generated from differing system configurations.

Date: Wednesday, June 12th, 2024

Time: 10:00 AM – 12:00 PM

Location: 14-232b

Zoom:

<https://calpoly.zoom.us/j/4630684233?pwd=0gfF7kvZhDxwDVbaDLN6JQqjWYc6hJ.1>

Committee: Dr. Mukherjee, Dr. Mukhopadhyay, and Dr. Anderson

