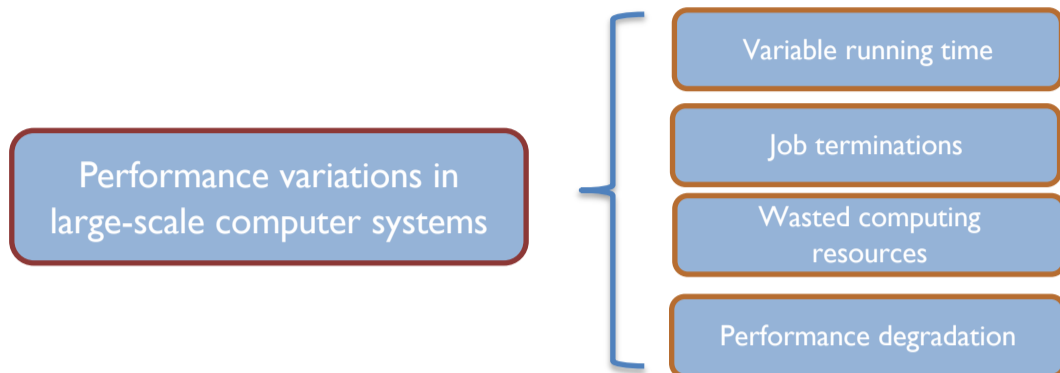


# Machine Learning-based Performance Analytics in Computer Systems

## Background and Motivation

- Significant growth in the scale of large-scale computing systems
- Over a million CPU cores
- Huge amount of performance data

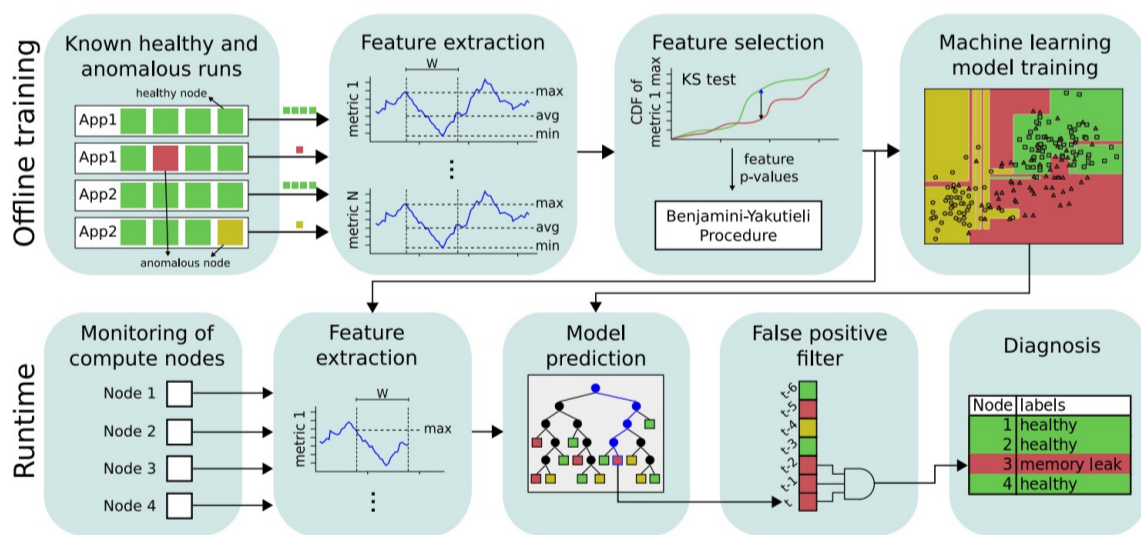


Problems caused by performance variations

## Challenges of Anomaly Diagnosis in Large Scale Computing Systems

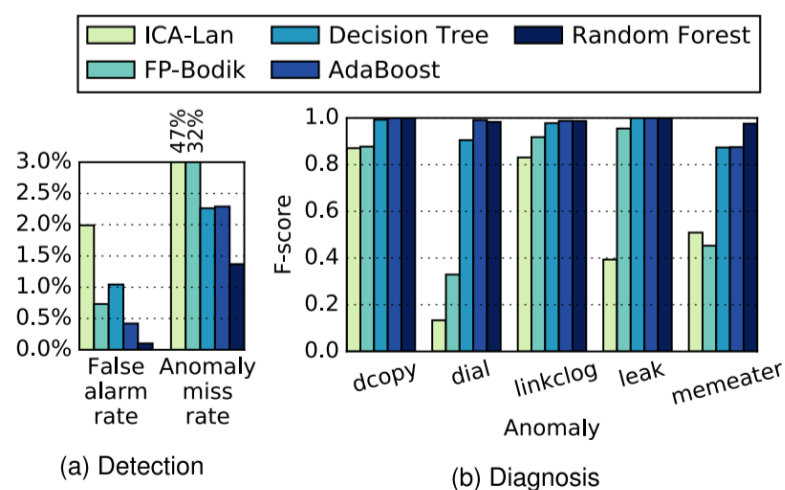
- Thousands of compute nodes generate GBs of system data which makes manual analysis infeasible
- A labeled dataset of large-scale system anomalies does not exist in literature

## ML-Based Online Anomaly Diagnosis Framework



Overall pipeline for supervised anomaly diagnosis framework

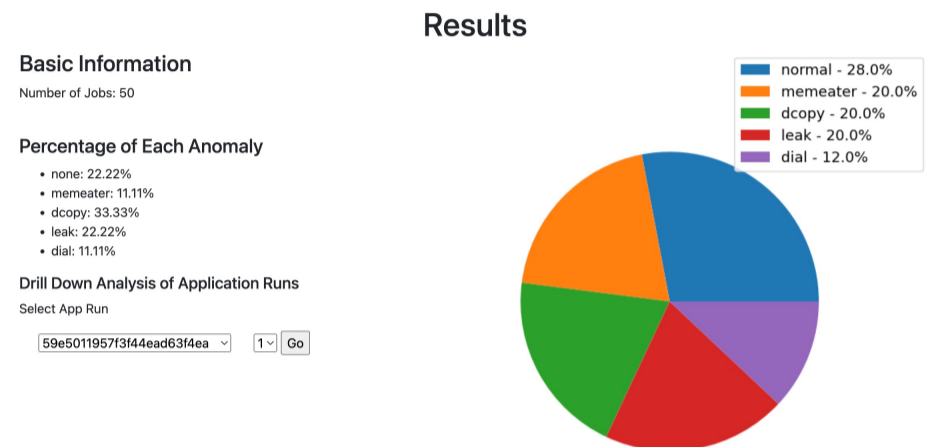
## Anomaly Diagnosis Results



Random forest correctly identifies **98** percent of the anomalies while leading to only 0.08 percent false anomaly alarms

## Web-based Anomaly Diagnosis Framework

- To make our anomaly diagnosis framework widely accessible, we created a web application
- Diagnoses anomalies in user uploaded system telemetry data
- Website link: <http://ai4hpc.bu.edu/>

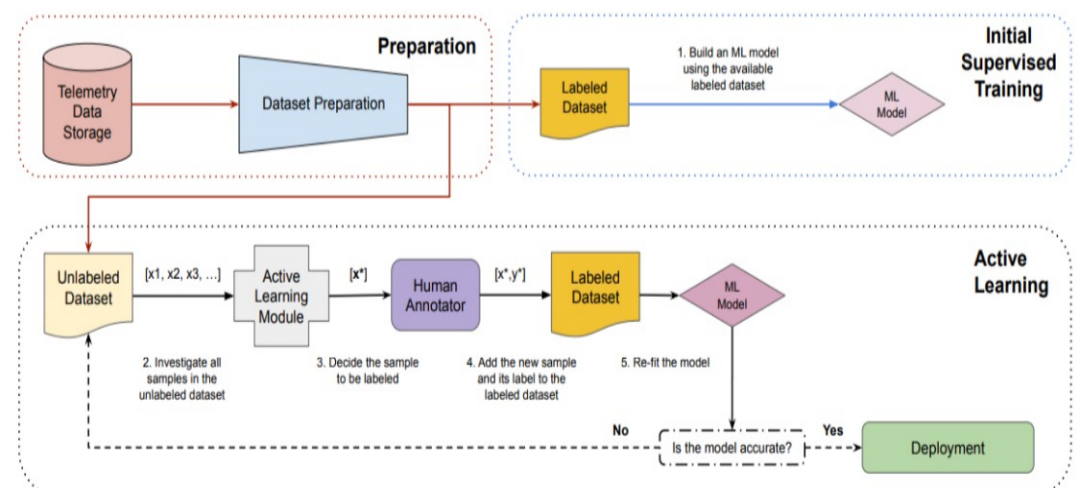


Anomaly diagnosis result of user uploaded telemetry data

## Limitations of Supervised Anomaly Diagnosis Framework

- Requires a large number of labeled samples
- The data collected from the monitoring systems is mostly unlabeled
- Obtaining ground truth labels for these samples is impractical

## Active Learning-based Anomaly Diagnosis Framework



Overall pipeline for active learning-based anomaly diagnosis framework

## References

- B. Aksar, E. Sencan, B. Schwaller, O. Aaziz, V. J. Leung, J. Brandt, M. Egele, and A. K. Coskun, "ALBADross: Active Learning Based Anomaly Diagnosis for Production HPC Systems" Cluster, 2022
- Ozan Tuncer, Emre Ates, Yijia Zhang, Ata Turk, Jim Brandt, Vitus J. Leung, Manuel Egele, and Ayse K. Coskun. Online Diagnosis of Performance Variation in HPC Systems Using Machine Learning, in IEEE Transactions on Parallel and Distributed Systems (TPDS), vol. 30, no. 4, pp. 883-896, April 2019