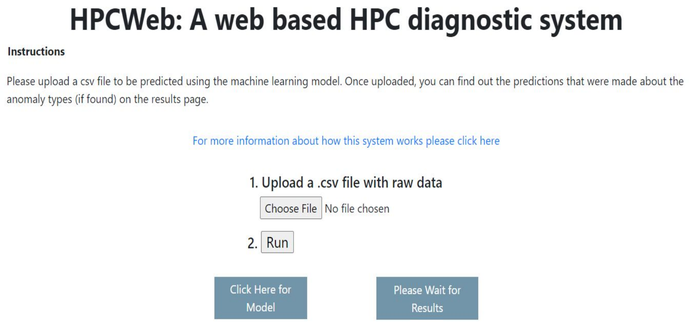
Web Application for HPC System Anomaly Diagnosis

Richard Chen[1,2], Efe Sencan[2], Prof. Ayse Coskun[2]

Canyon Crest Academy, 5951 Village Center Loop Rd, San Diego, CA 92130[1], Boston University Electrical and Computer Engineering Department, 8 St Mary's St, Boston, MA 02215[2]

Introduction

- High-Performance Computing (HPC) systems growing larger and more complex
  - Runs scientific simulations and AI
- HPC Systems suffer from performance variations
  - Resource contention, memory leaks, and hardware related problems
  - Leads to higher energy consumption
- Machine Learning (ML) models created
  - Hard to use
  - Outputs are complicated to interpret for lay people
- Synthetic Anomalies Diagnosed in model:
  - dcopy
  - memeater
  - dial
  - leak
- Web application created in order to produce better insight



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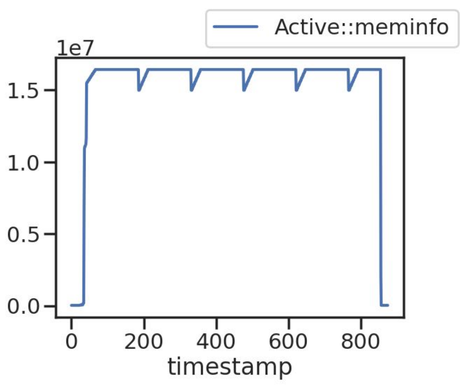
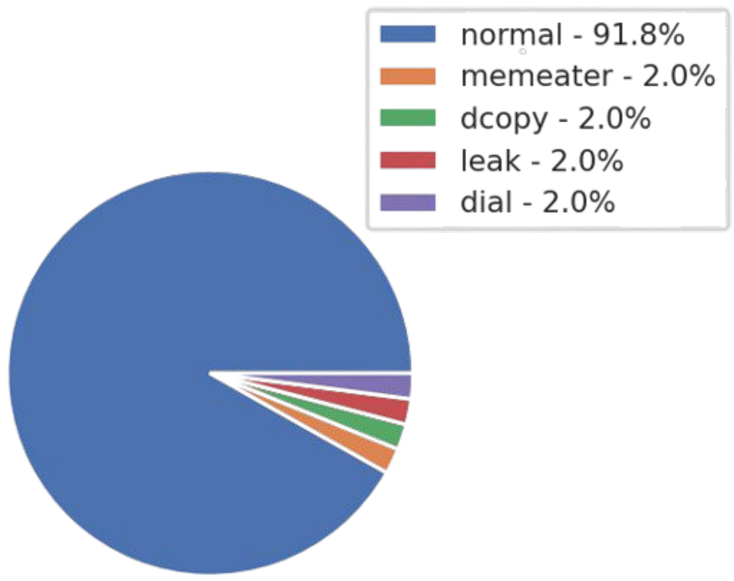
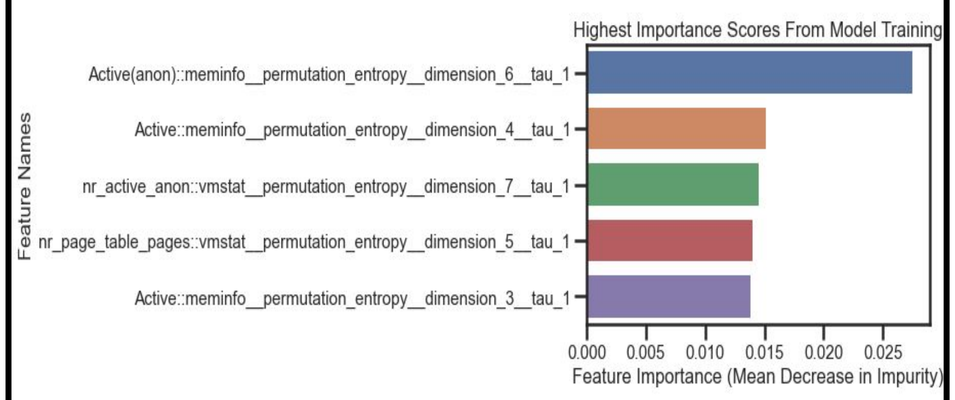


Sample Graphed Telemetry Data from HPC System

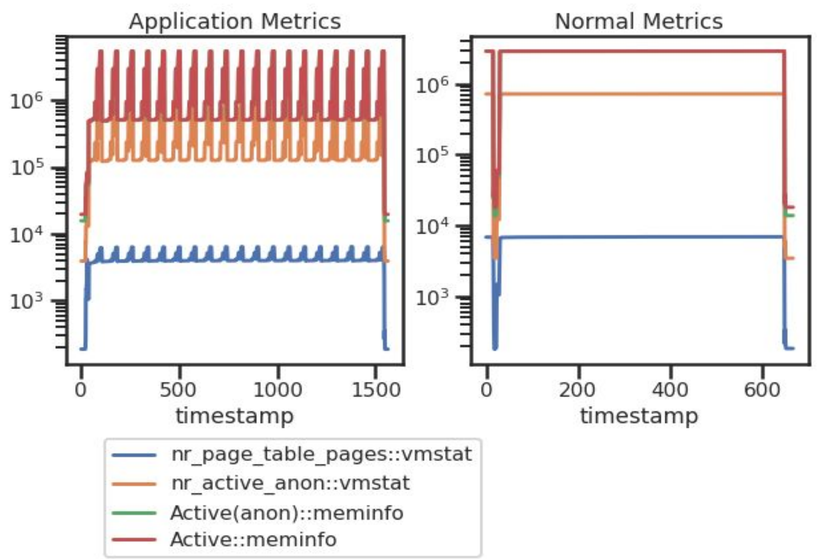
Results



Sample pie chart output for proportion of anomalous and healthy nodes in a HPC system



Most important features during model training



Example comparison between an anomalous process (left) and a healthy process (right)

Discussion/ Conclusions

- HPC systems increasing in computational power
  - Performance variations more likely
  - Easy to use diagnosis frameworks more important
- Anomalies have different metric signatures
- Real world scenarios consists mainly of healthy job runs
- Easily gain insight on HPC systems and performance variations within the system
  - HPC users know what lead to diagnosis
  - Users can see visuals of the ratio of anomalies
  - Side by side healthy vs anomalous graphs
    - Easily see distinctions
    - Distinguish what features led to anomaly diagnosis

Future Work

- Integrate methods for run time diagnosis
  - Allows users to see exact time an anomaly occurs within system
- Deploy website onto a web server in future
  - Allows more people in the HPC community to gain access to ML model
  - Get user feedback to improve functionality of website
- Improve efficiency

Methodology

1. User interface created using Python Flask and HTML
2. ML model trained using train data and labels
3. Efficacy of model tested using raw telemetry data
4. Predicted results shown in charts developed using Matplotlib

References

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[2] Tuncer, O., Ates, E., Zhang, Y., Turk, A., Brandt, J., Leung, V. J., Egele, M., & Coskun, A. K. (2019). Online diagnosis of performance variation in HPC systems using Machine Learning. *IEEE Transactions on Parallel and Distributed Systems*, *30*(4), 883–896. https://doi.org/10.1109/tpds.2018.2870403

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