

# **Comparative Evaluation of Streaming Deep Outlier Detection Techniques for Time Series Data**

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# PROBLEM & R.Q.



- Wide spectrum of Outlier Detection Methods
- Evaluation urden
- Lack of Deep Outlier Techiques comparison
- Streaming scenario

How do outlier detection techniques perform and compare over different real-life datasets?



# BACKGROUND

- **Nature of the Anomaly:** Point, Contextual, Collective
- **Input Data:** Univariate Time Series
- **Output:** Scores or Binary Labels



TELEMANOM



OED



DONUT

# RELATED WORK



# METHODOLOGY (1/2)

## EXPERIMENTAL

Research methodology

## NAB

Real life dataset for  
benchmarks

### 1<sup>st</sup> PHASE

Compare algorithms  
on offline settings

### 2<sup>nd</sup> PHASE

Compare algorithms  
on streaming scenario

# METHODOLOGY (2/2)

1

## STANDARD METRICS

- Precision
- Recall
- F1 Score

2

## NAB METRICS

- SA Profile
- Reward Low FP Rate
- Reward Low FN Rate

# RESULTS & ANALYSIS (1/2)

	Ambient	CPU Use	EC2 Lat.	Machine	NYC Taxi
	P – R – F1	P – R – F1	P – R – F1	P – R – F1	P – R – F1
TELEMANOM	0.67 – 1 – 0.8	0.33 – 0.5 – 0.4	0 – 0 – 0	1 – 0.5 – 0.67	1 – 0.6 – 0.75
OED	0.67 – 1 – 0.8	0.5 – 0.5 – 0.5	1 – 1 – 1	1 – 0.5 – 0.67	0.6 – 0.6 – 0.6
DONUT	0.67 – 1 – 0.8	0.5 – 0.5 – 0.5	1 – 1 – 1	0.5 – 0.5 – 0.5	0.5 – 0.4 – 0.44

# RESULTS & ANALYSIS (2/2)

	Ambient	CPU Use	EC2 Lat.	Machine	NYC Taxi
	SP – A1 – A2				
TELEMANOM	49.57-49.57-66.09	50-50-66.67	0-0-0	49.14-49.14-65.52	49.14-49.14-65.52
OED	49.14-49.14-65.52	49.57-49.57-65.09	49.81-49.81-66.54	48.28-48.28-64.37	49.30-48.10-65.92
DONUT	49.57-49.57-66.23	50-50-66.67	50.24-50.05-66.82	49.31-49.14-66.21	49.14-49.14-65.67

# CONCLUSIONS



## GENERAL

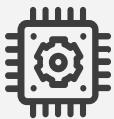
- All the algos work in a streaming scenario
- Almost equally performance
- Techniques work in different domains



## PERFORMANCE

- Donut better results
- Telemanom good score
- OED better offline scenario
- Scarce results on NAB

# FUTURE WORKS



## DATA & ALGO

Extension to more datasets and benchmarks.  
New unsupervised algorithm can be added



## CONTEXTUAL

Extension to algorithms for detection of contextual outliers (type II)



## MULTIVARIATE

Extension to multivariate time series data and focus on hyperparameters tuning

# THANKS

Do you have any questions?

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