Long-Term Pattern of Life Analysis and Anomaly Detection

Khurram Hassan Shafique, PhD
Solving key machine learning and sensor exploitation challenges to enable smart autonomous systems
Patterns of Life

- Handle long-duration data
  - Spanning years
- Learn and model temporal variations at different resolution
  - Daily, weekly, monthly
  - Seasonal
  - Cultural
- Identify anomalies
Patterns of Life

• **Handle long-duration data**
  • Spanning years

• **Learn and model temporal variations at different resolution**
  • Daily, weekly, monthly
  • Seasonal
  • Cultural

• **Identify anomalies**

• **Challenges**
  • No annotations
  • Inability to handle long-term temporal dependencies
  • Catastrophic forgetting
Track Anomalies
City-wide Anomalies

Unsupervised Life-long Learning

Detected Anomalies

Network activity

Date

Queima das Fitas
St. John’s Day
NOS Primavera Sound
Serralves em Festa
Detecting city-wide anomalies
Detecting city-wide anomalies

Queima das Fitas ("Ribbon Burning")
May 4-11, 2014
Detecting city-wide anomalies

Festa de São João do Porto (St. John’s Day) June 23, 2014
Detecting city-wide anomalies

Festa de São João do Porto (St. John’s Day)
Detecting city-wide anomalies

Festa de São João do Porto (St. John’s Day)

June 23, 2014
Cultural events from pedestrian behavior
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