

## **GSAW 2017 Tutorial A:**

### Operational Analytics and Big Data Technologies

**Length:** Half day

#### **Overview:**

Sensor systems record significant amounts of data, but due to sheer volumes of data they often cannot be analyzed except in cases where anomalies have already impacted system performance. This tutorial presents a methodology of implementing an operational analytic solution that when combined with Big Data technologies and predictive techniques, has been shown to be valuable in detecting mission critical system anomalies that might be missed by conventional analytical techniques. The methodology we present incorporates patterns of life analyses to establish a system's past behavior, determine its current behavior, and predict its future behavior. This allows us to predict when system failures are likely to reach a critical point. Our methodology uses a three step approach of data discovery, machine learning and training of data modeling and predictive techniques, and operational deployment that identifies anomalies and serves as a decision aid in taking preventive and/or corrective actions. In this tutorial, we present how to process data, evaluate the patterns of life, and separate normal or expected behavior from anomalous behavior. We describe the implementation of evolving functional architectures for each phase which facilitates the exploration of the patterns of life and helps determine practical analytic, visualization, and predictive technologies tailored for system operations.

The methodology in this tutorial helps analysts and decision makers make informed and rapid decisions about possible root causes of problems by automatically analyzing large volumes of complex data in near real-time and presenting it in a manner that facilitates interpretation. Normal analyses may only be performed on a daily or weekly basis so by providing the analyses and projections in near real time the system can be fixed before it reaches a critical state. Operational Analytics and Patterns of Life analyses provide cost savings by being able to alert and predict when system degradations pass a critical threshold and impact mission operations.

- Operational Analytics – What is it?
- What constitutes Big Data in systems?
- Methodology for implementing operational analytics
  - Discovery
  - Modelling
  - Deployment
- Discovery
  - Finding relationships and correlations
  - Detecting Patterns of Life
    - What are Patterns of Life?
    - What constitutes anomalous vs normal behavior?
  - When normal data correlations aren't enough
  - Architectures for discovery
  - Example implementation using Elasticsearch, LogStash & Kibana
- Modelling
  - What is modelling?
  - Why is modeling time intensive?
  - Standard models versus custom models
  - Architectures for modelling

- Projections and forecasting
- Example implementation using Apache Spark, ARIMA and R
- Deployment
  - Architecture trades for deployment
  - Visualizations
    - Live Dashboard concepts and tools
    - Determining what should be displayed – knowing your audience
  - Performance
- Architectures
  - Data Storage
  - Data Analysis
  - Data Visualization
  - Cloud Storage and Computing
  - Performance Trades

**Instructors:** Joseph Coughlin, Rohit Mital, and Shashi Nittur, Stinger Ghaffarian Technologies

**Biographies:**

**Joseph Coughlin** – is a Senior Systems Engineer for Stinger Ghaffarian Technologies (SGT). He has spent over 30 years working science and systems engineering tasks for a wide variety of customers. He is currently working on operational upgrades to the PARCS, Eglin, and Pave PAWS radar systems and GEODSS optical sensors to improve Space Domain Awareness. He has also been working on Operational Analytics problems to diagnose sensor anomalies. He received a Master’s Degree in Astrophysical, Planetary and Atmospheric Physics from the University of Colorado.

**Rohit Mital** – is the Chief Technology Officer for Stinger Ghaffarian Technologies (SGT). He has over 25 years of experience in developing and delivering high-performance, scalable, complex software systems and solutions. He currently leads SGT’s Innovations Labs, which is developing solutions in Agile/DevOps, Big Data, Machine Learning and Operational Analytics for SGTs customers. He has Master’s degrees in Electrical Engineering and Mathematics.

**Shashi Nittur** – is Consultant advising organizations on Big Data Strategy, Predictive Analytics, and emerging technologies. He has over 15 years of experience in architecting petabyte scale data solutions, training and mentoring teams in building complex data solutions. He has a Master’s degree in Engineering.

**Description of Intended Students and Prerequisites:**

Tutorial is designed for a non-technical as well as a technical audience. Tutorial is for those interested in real time data ingest, store and analysis using Big Data technologies.

**What can Attendees Expect to Learn:**

- A methodology to transform a big data problem into solutions providing meaningful insights to analysts and decision makers
- Architectural solutions to addressing big data demonstrating high scalability
- Identification of patterns of life within data