PHM Applications Deployment
System approach for PHM applications deployment
Topics to discuss:

- Environment for Remote Monitoring and Diagnostic
- Feedback-loops build into applications
- Alert scenarios – with or w/o human intervention
- Cycle time – implementation time
- Monitoring and manageing sets of models at the production-level
Panelists:

• **Xinyu Du**, Senior Researcher Vehicle Health Management Group, General Motors Global R&D

• **Kathy Elliott**, Performance Capability Manager, Defense at Rolls-Royce

• **Jayant SEN GUPTA**, Data Science Research Project Leader @ Airbus Central R&T, Airbus

• **Adam McElhinney**, Vice President Data Science, Uptake

• **Sven Pörschmann**, Manager Analytics & Data Solutions, Lufthansa Technik AG

• **Glen Shaffer**, Executive Manager Global Services Organization-Prognostics, GE Transportation
PHM Applications Deployment Panel

• Xinyu Du
Xinyu Du

• Senior Researcher at Vehicle Health Management Group, Vehicle Systems Research Lab, General Motors Global R&D

• Have 36 Patents (Applications), 7 GM Internal Inventions and 35 Publications

• Experiences in Automotive PHM: Battery, Starter, Controller Area Network, Electronic Control Unit, Brake, Steering and Suspension System.

• The Boss Kettering Award Recipient from General Motors (2015) and INFORMs award (2016) for his contribution in Integrated Starting System Prognosis.

• Associate Editor for IEEE Access and Journal of Intelligent and Fuzzy Systems

• Ph.D. in Electrical Engineering from Wayne State University, USA
OnStar Proactive Alert Service

Big data is the key to verify the PHM application and validate the deployment.
ECU Network Diagnostics and Prognostics

1. ECU Lost Fault Detection
2. Wire Open Detection (When)
3. Wire Open Localization (Where)
4. Wire Open Isolation (Which)
5. Wire Short Detection/Isolation
6. ECU Floating Ground Detection/Localization
7. ECU Ground Offset Detection/Localization/Prognostics
8. CAN Reversed Wire Detection/Isolation/Localization
9. Two-Terminators Loss Isolation

Good hardware-in-the-loop (HIL) bench and thorough Design Failure Mode and Effect Analysis (DFMEA) are important to reduce the verification time.
Kathryn Elliott
Performance Capability Manager, Defense Sector
Rolls-Royce Corporation

• 30+ years gas turbine engine OEM experience (System Performance)
• Global Lead SME for In-Service Performance
• Chair, SAE E-32 Aerospace Propulsion Systems Health Management Standards Committee
• EHM Capability Development for Corporate, Regional, & Unmanned Applications
Kathryn Elliott
Performance Capability Manager, Defense Sector
Rolls-Royce Corporation

Regional Airlines
1600 Engines in Service
60+ Million Flight Hours
70 Operators
Embraer E-135/140/145

Business/Private Jet
1400 Engines in Service
10 Million Flight Hours
450 Operators
Embraer 650 Legacy, Legacy+
Cessna Citation X, Citation TEN

Military UAV
1 operator
Northrup Grumman Global Hawk
PHM Applications
Deployment

Jayant SEN GUPTA (Airbus)
Personal involvement in PHM

• **Education**
  • MSc. Ecole Polytechnique
  • PhD ENS Cachan (computational mechanics)

• **Research activities**
  • Formalization of PHM
  • What method/algorithm depending on available information?
  • Development of a prognostics module (OSA-CBM)
  • Methods to define health indicators (mostly data-driven)

• **Business activities**
  • Integration of prognostics module into PHM service
  • Organization of transverse teams to operate, improve such service
  • Contribution to development of analysis tools used in service
PHM deployment for a fleet of aircraft

Aircraft design

➢ Put sensors?
➢ Prepare connectivity
➢ Design for PHM?
➢ System knowledge
➢ Flight test and integration

Aircraft operations

➢ Collect data (sensors, missions, etc., maintenance logs...)
➢ Learn from data
  - Investigate problems
  - Define normal behaviours
  - Aggregation levels?
➢ Capture knowledge
➢ Provide useful advice to customer
  - Human-in-the-loop
  - Automated decision
  - No false positive
➢ Capture customer feedback
Good practices for algorithms/models deployment

Connected fleet

Collaborative environment

Customer centric

Co-located team

Continuous integration
Chief of Machine Learning & AI Strategy at Uptake

Adjunct Professor, Illinois Institute of Technology

MORE ABOUT ME

• MS Statistics, University of Illinois at Chicago
• President, Chicago Chapter American Statistical Association
• Illinois Technology Association 2018 Technologist of the Year
• 3 patents issued, 15 applied

I AM PASSIONATE ABOUT

• Machine learning
• Open source software
• STEM education
• Cooking
• Hiking
Uptake is the leading AI software provider for industrial companies.
Our differentiated portfolio

150B data points ingested per month

55,000+ failure modes

1,300+ models deployed

<2 minutes to deploy a trained model

1.2B hours of operating data
My team

- **150+** combined issued patents or patents filed listing our data scientists as inventors
- **4** Kaggle competitors
- **70+** team members

Varied backgrounds including engineering, statistics, finance and neuroscience
- Former employees from NASA, Google and Facebook
- Creators of multiple open source projects (e.g. uptasticsearch, pknet, updraft, cran-server) and contributions to others (e.g. Julia, numpy, LightGBM).
- Founding scientists and patent writer for SmartSignal
- Advisory network including top universities such as Carnegie Mellon, UTK, Yale, and University of Chicago
What we do

**PRODUCT DEVELOPMENT & CONFIGURATION**
- Team assigned to specific verticals
- Deploying features for those products into production
- Gaining subject matter expertise

**PLATFORM DEVELOPMENT**
- General purpose “Data Science Engines”
- Distributed Industrial AI platform

**ONBOARDING OF NEW INDUSTRIES & CUSTOMERS**
- Analytics translation
- Mapping to Uptake Platform
- Value measurement
What you should ask me about

Machine learning
Open source software
Distributed computing
Scaling data science teams
Software development
Hybrid physics and ml prognostics
PHM
FROM IDEA TO 24/7
Digitize the Industry

PHM

Digitize the Core

MVP

DevOps

Automation

Fulfillment

Partner

Data Ownership

Reliability

Agile

Customer Centricity

Identify Pains

Digital ↔ Physical Connection

Availability
Our PREDICTOR assembly line

"Few ideas work on the first try. Iteration is key to innovation."
Sebastian Thrun
Keep Flying!

DESIGN  PRODUCE  OPERATE  MAINTAIN
Let’s shape the future of aviation TOGETHER
PHM Applications Deployment - Panel Discussion

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