Cloud-based Machine Health Monitoring and Prognosis

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Industrial relevance

- It has been very challenging for manufacturers to minimize unexpected machine down times by predicting remaining useful life of machinery as well as perform proactive maintenance actions.
- A data-driven and scalable prognostic framework that integrates machine learning and cloud computing has the potential to collect large volumes of real-time streaming data and create predictive models in real-time.

Thrust area: Develop intelligent and data-driven systems for better and faster technical and business decisions

Current TRL: TRL 3 – Experimental proof of concept

Final TRL: Estimate final TRL 6 – Technology demonstrated in industrially relevant environments

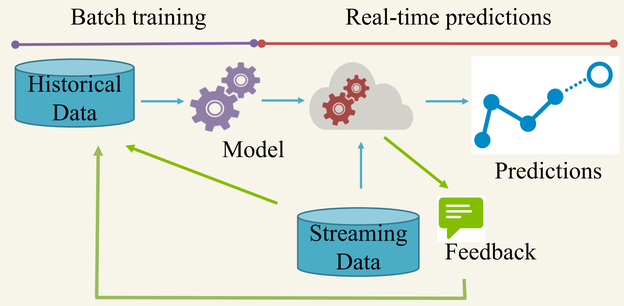
Project type: Proposed

Percent complete: 0%

Problem statement

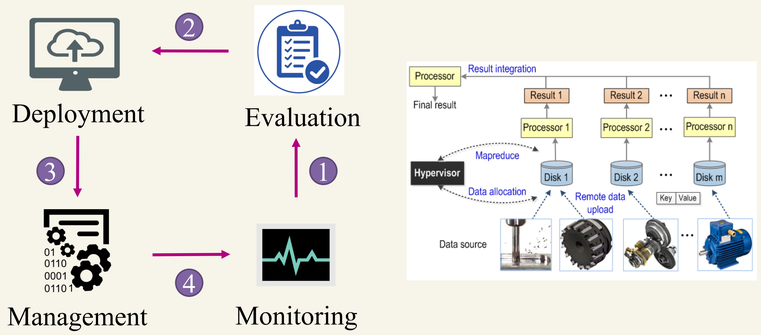
- Manufacturers aim to minimize unexpected machine down times by predicting mechanical failures and performing proactive maintenance actions.
- Existing prognostic systems are not capable of monitoring the conditions of large-scale distributed manufacturing systems as well as collecting and analyzing high-speed, large-volume heterogeneous data.
- The objective of this project is to create a prognostic framework for intelligent maintenance using machine learning and cloud computing.

Approach and method



Deliverables and benefits

- A cloud-based data acquisition system that will integrate a wireless sensing system with a scalable, high performance cloud computing infrastructure;
- A cloud-based machine learning algorithm that will process real-time streaming data and generates big data analytics.



Potential application areas

- Manufacturing
- Automotive
- Aerospace
- Power generation
- Transportation

Project plan and progress

Research Tasks	2016		2017		
	8 - 10	11 - 12	1 - 3	4 - 6	7 - 8
1. Build a cloud-based sensing system using wireless sensors and cloud					
2. Collect real-time streaming data from milling machines and 3D printers					
3. Develop parallel machine learning algorithms					
4. Test the parallel machine learning algorithms					
5. Documentation					

Current state of practice and research

- Physics-based prognostics – Predict system performance using a mathematical representation of the physical behavior of degradation processes. However, physics-based methods require deep and complete knowledge of system behaviors which is typically not readily available for many applications.
- Model-based prognostics – Predict system performance based on probability distribution. The limitation of model-based prognostics is that one has to assume that the underlying process follows certain probability distribution.

How ours is different

- Real-time streaming data processing and big data analytics
- Scalable and high performance computing
- More accurate prediction without complete knowledge of physical behaviors