Cloud-based Machine Health Monitoring and Prognosis

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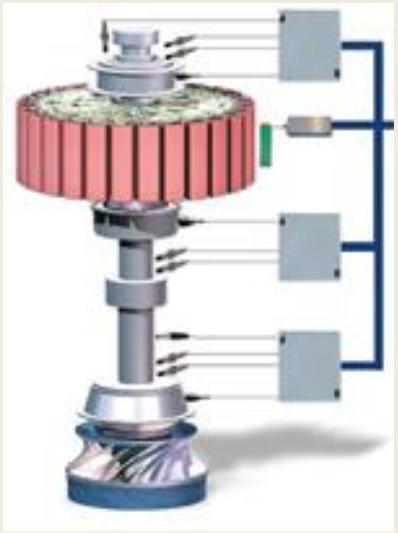
Industrial relevance

- Problem: It has been very challenging for manufacturers to predict remaining useful life of machinery in real-time as well as perform proactive maintenance actions.



Monitoring

- Vibration
- Force
- Speed
- Torque
- Temperature

Diagnosis

- Fault Detection
- Fault Isolation
- Fault Identification

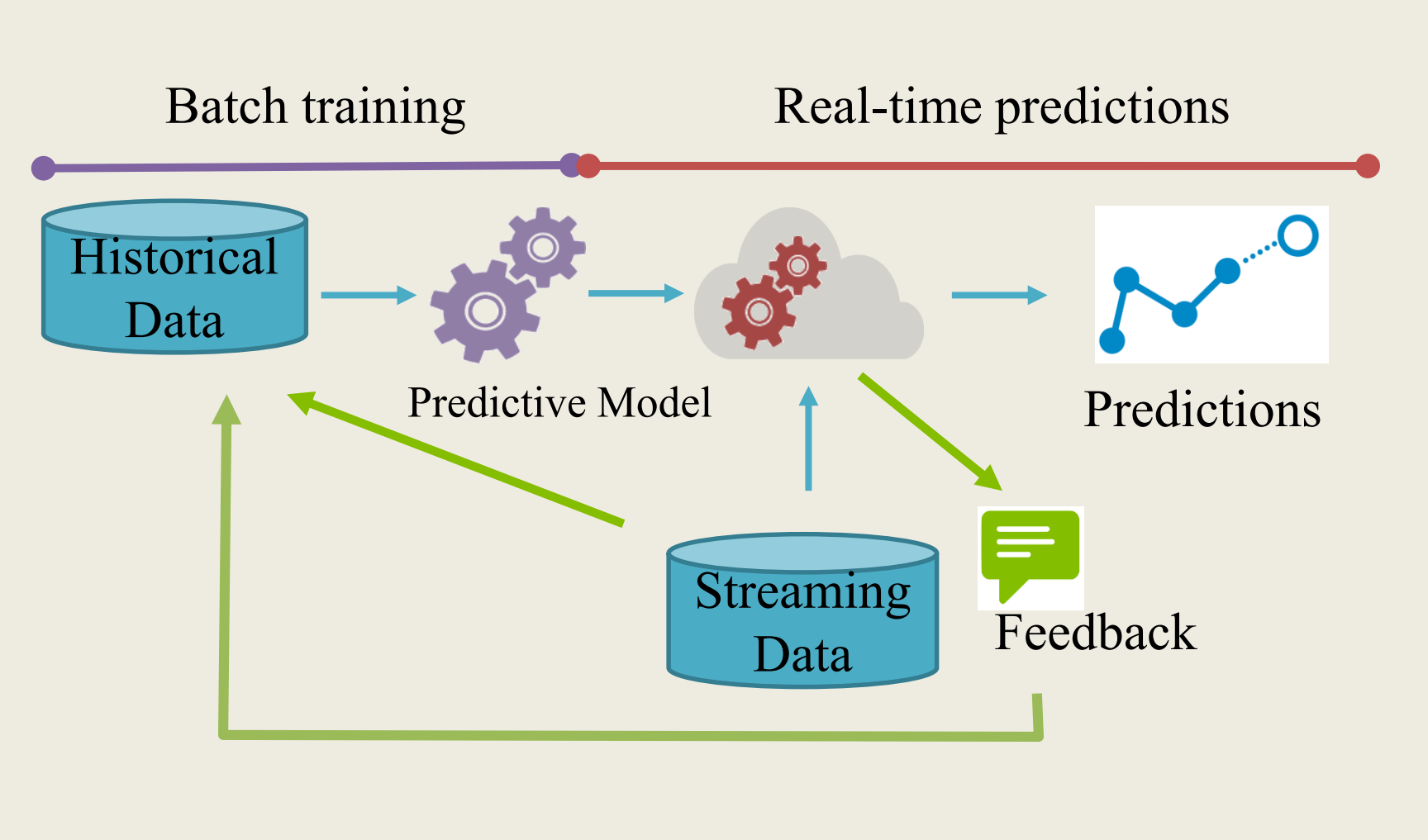
Project details

- Thrust area: Intelligence - develop intelligent and data-driven systems for better and faster technical and business decisions
- Current TRL: 3 - Experimental proof of concept
- Final TRL: 6 - Technology demonstrated in industrially relevant environments
- Project type: Proposed
- Percent complete: 0%

Problem statement

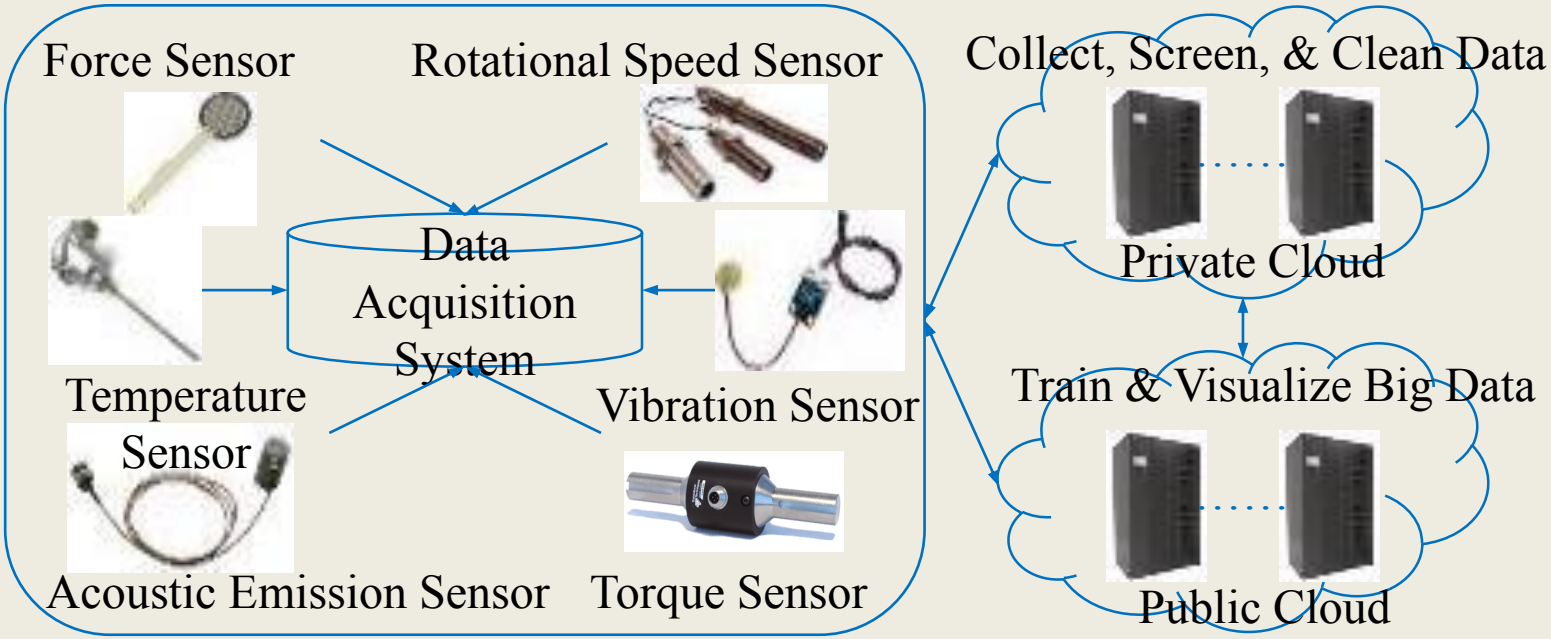
- Existing prognostic systems are not capable of monitoring the conditions of large-scale distributed manufacturing systems as well as collecting and analyzing high-speed, large-volume heterogeneous data.
- The objective of this project is to create a prognostic framework for intelligent maintenance using machine learning and cloud computing.

Approach & method



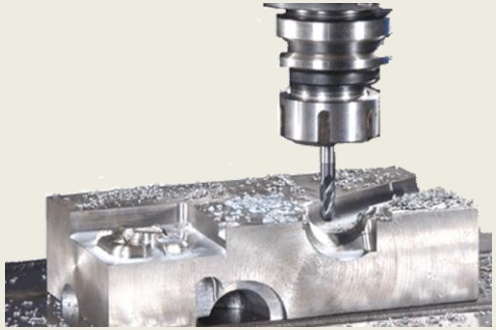
Deliverables & benefits

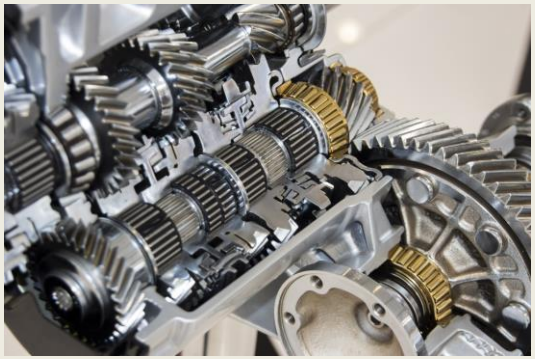
- A cloud-based data acquisition system that integrates a wireless sensing system with a cloud computing infrastructure;
- A cloud-based machine learning algorithm that processes real-time streaming data and generates big data analytics;

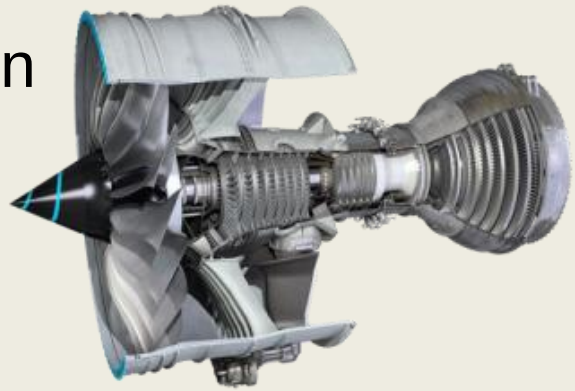


Potential application areas

- Manufacturing
- Automotive
- Aerospace
- Power generation
- Transportation







Project plan

- Length of project: 12 months

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

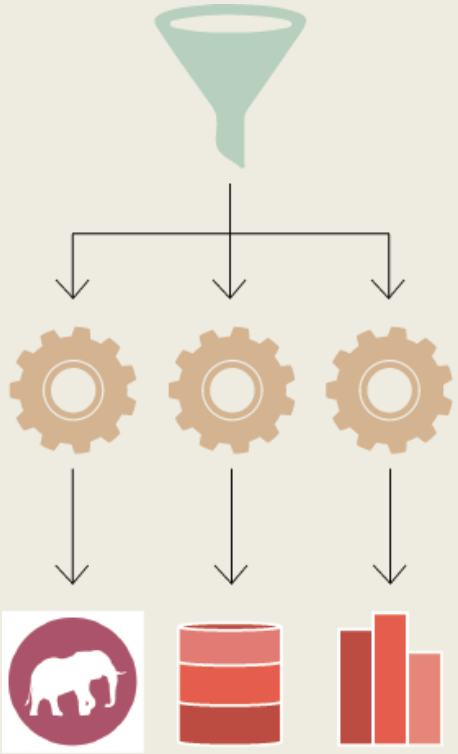
Current state of practice & research

- 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
- Prediction without complete knowledge of physical behaviors



Collect high-speed, large volumes of streaming data

Machine learning and cloud computing

Generate data analytics as it flows