Product Obsolescence Forecasting

INTRODUCTION

A study by the Department of Defense estimated the U.S. government spends over $10 billion annually on managing and mitigating obsolescence. The substantial cost is largely based on the lack of options caused by reactionary management styles. Managers are forced to choose costly reactionary alternatives simply because of inadequate means for predicting when components will become obsolete. This research solves this problem with a new more accurate obsolescence forecasting method that can be utilized by industry, ultimately enabling the shift away from reactive practices toward more proactive obsolescence management.

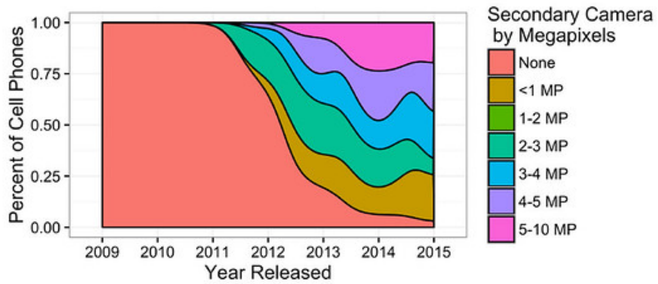
APPLICATIONS

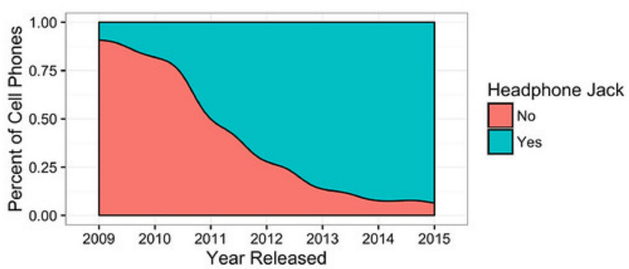
- Design:

Designers can submit BOMs to the obsolescence forecasting system and receive the obsolescence risk level for all components in the BOM. Parts with a high risk of obsolescence can be replaced or redesigned before finalized plans are sent to manufacturing.

- Supply Chain:

Product life cycle predictions can be utilized by supply chain managers to more effectively forecast life time buy order quantities by more accurately predicting when the product will reach end-of-life.





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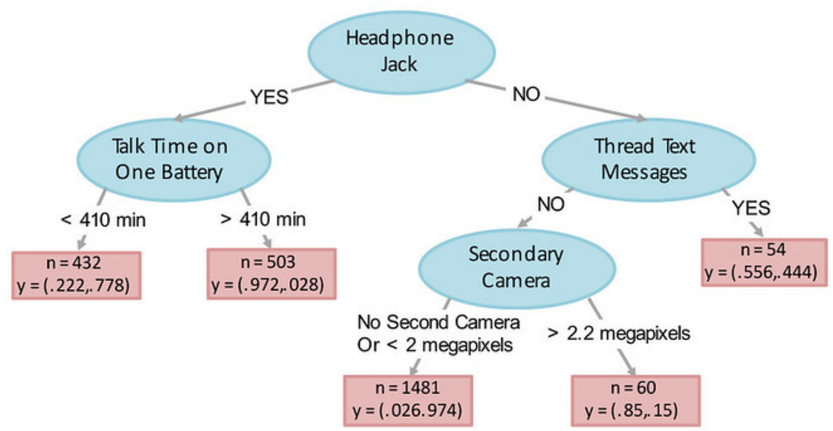
ABSTRACT

Rapid changes in technology have led to an increasingly fast pace of product introductions, causing many components to become obsolete. Over the years, many approaches to forecasting obsolescence have been developed. Gathering inputs required for forecasting has often been subjective and laborious, causing inconsistences in predictions. To address this issue, the objective of this research is to develop a new framework and methodology capable of identifying and forecasting obsolescence with a high degree of accuracy while minimizing maintenance and upkeep. Using modern data mining techniques, a machine learning methodology capable of predicting obsolescence risk level and estimating the date of obsolescence has been developed.

Obsolescence Forecasting Decision Tree in the Cell Phone Market



Decision Tree Classification Results

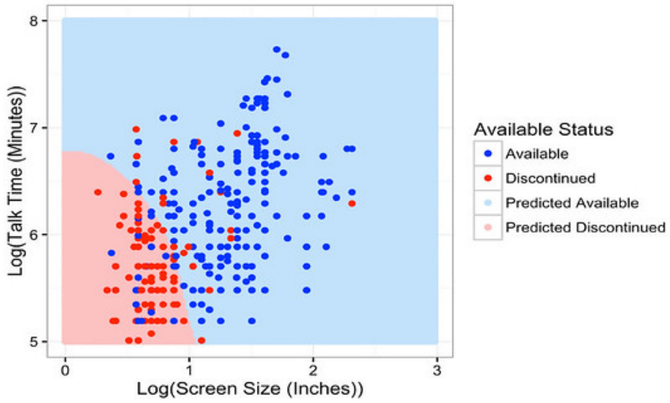
		Prediction		
		Available	Discontinued	Total
Actual	Available	570	134	704 (80.97%)
	Discontinued	47	1779	1826 (97.43%)
	Total	617 (92.38%)	1913 (93%)	2530 (92.85%)

RESEARCH QUESTIONS

- Is machine learning suitable for predicting obsolescence?
- How does machine learning compare to previous obsolescence forecasting methods?
- How to apply machine learning based obsolescence forecasting to current proactive obsolescence management strategies to improve the effectiveness?
- How to gain technical design requirements from obsolescence forecasting decision trees?

CONCLUSION

- The machine learning methodology presented in this research was able to predict obsolescence status with as high as 98% accuracy and the date of obsolescence within a few months.
- Random forest was the best algorithm for obsolescence risk forecasting and support vector machine was the best for forecasting product life cycle.
- Using variable importance from the machine learning algorithms can prioritize design requirements to minimize the effect of technical obsolescence through a product's life cycle.



Support Vector Machine Example

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Cloud-Based Digital Manufacturing

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Abstract:
Cloud-Based Digital Manufacturing (CBDM) refers to a customer-centric manufacturing model that exploits on-demand access to a shared collection of diversified and distributed manufacturing resources to form temporary, reconfigurable production lines which enhance efficiency, reduce product lifecycle costs, and allow for optimal resource loading in response to variable-demand customer generated tasking. Our objective is to present the drivers, current status of research and development, and future trends of CBDM. We also discuss the potential short term and long term impacts of CBDM on various sectors.

INTRODUCTION

In recent years, the IT sector at large has significantly benefitted from cloud computing through (1) on-demand self-services, (2) ubiquitous network access, (3) rapid elasticity, (4) pay-per-use, (5) location-independent resource pooling. Of particular interest is that cloud computing allows for more affordable and flexible IT solutions compared to traditional infrastructure and service models. As cloud computing is already widely accepted in the IT field, the concept of cloud-based digital manufacturing (CBDM), as well as its current status and future are presented.

CURRENT STATUS

- Automation:

Automation technologies facilitate inter- and intra-factory communication and collaboration in CBDM environments, allowing for automatically executing manufacturing tasks generated by CBDM consumers.

- Service Composition:

As service consumers focus on their core business and outsource other application series over Internet, service composition becomes critical which deals with selecting and integrating inter-organizational and heterogeneous services in CBDM environments.

- Business Model:

For CBDM to be embraced by service consumers and providers, current business models incorporate the concepts of crowdsourcing, customer co-creation, and social product development.

- Collaborator Selection:

As more and more service consumers and providers get involved in CBDM, it is crucial for the cloud to have the searching capability for collaborator selection which helps the consumers find the suitable suppliers in the CBDM network.

- Implementation Architecture:

Due to the complexity of the CBDM systems, implementation architectures consist of multiple layers including user, centralized portal, application, service, and manufacturing resource layers.

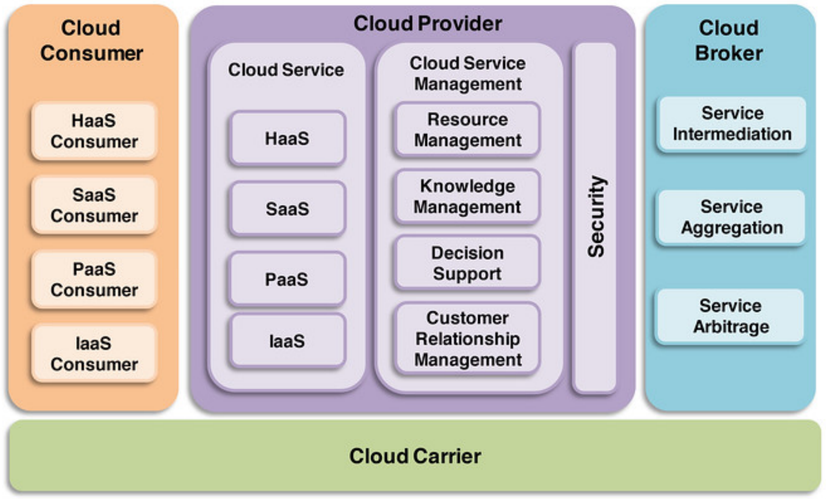

Figure 1. CBDM conceptual reference model

Table 1. Drivers and metrics for CBDM

Drivers	Metrics
Economy	Cost
Agility	Response time to market changes
Scalability	Throughput, utilization
Resource sharing	Amount of pooled resources
Information sharing	Semantic similarity, interoperability
Social sphere	Centrality and network density

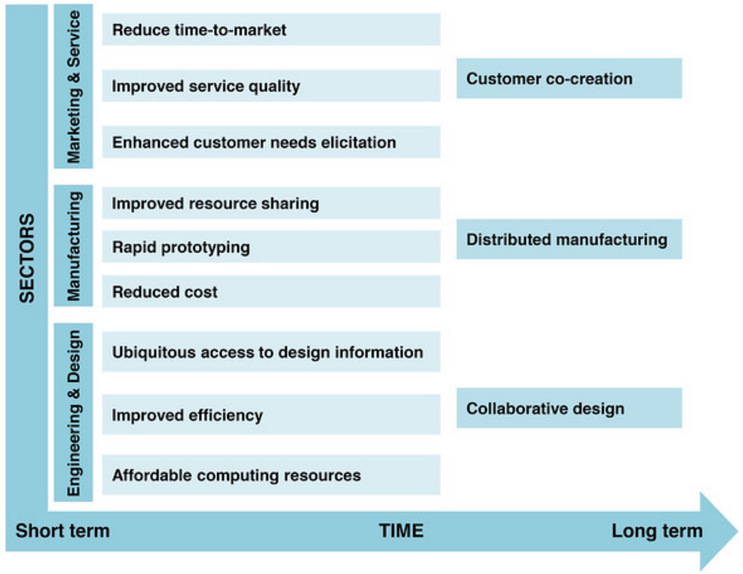

Figure 2. Potential impact of CBDM across sectors

RESEARCH QUESTIONS

- What are the standards needed to describe the function, structure, behavior of the networked equipment in the cloud which allows for automatic and remote machine-to-machine communication?
- How to apply semantic web technology in order to facilitate effective manufacturing resource sharing and reuse across geographically dispersed enterprises?
- What are the key characteristics of the effective CBDM business models that can provide the service consumers and providers unique value?
- How to model the socio-technical network in CBDM and how to identify key actors and potential collaborators in the network?
- How to incorporate the concept of software-as-a-service, platform-as-a-service, infrastructure-as-a-service, and hardware-as-a-service into CBDM?

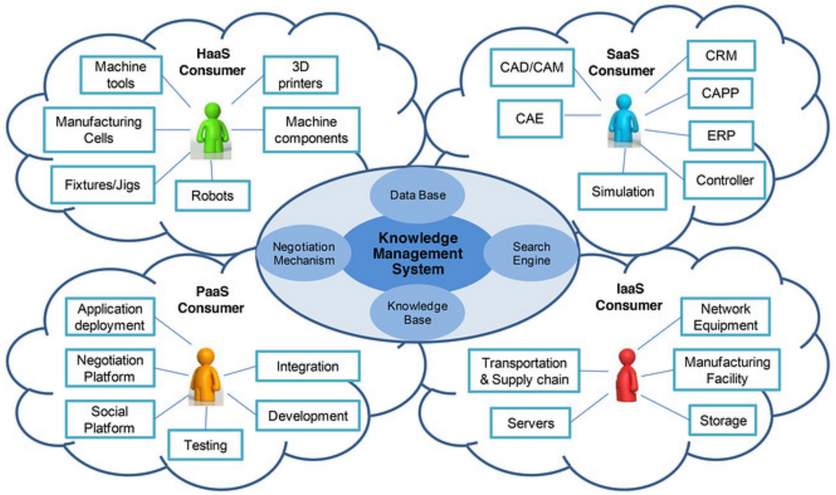

Figure 3. CBDM example services

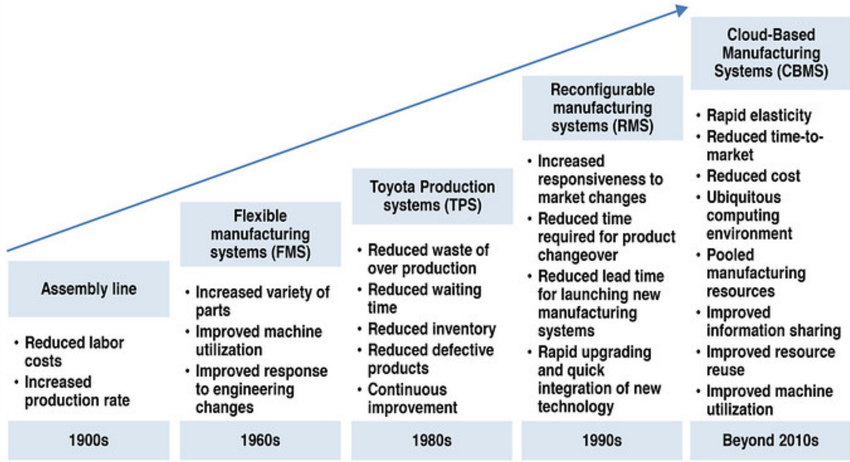

Figure 4. A history of manufacturing systems development