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Ways in which Machine Learning and IoT Transform Automotive and Healthcare Industries

Possible outcomes and scenarios

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Abstract

This document posits that IoT based projects achieve greater value when they include machine learning. IoT devices generate large amounts of data that machine learning models leverage to extract valuable information.

The document provides specific use cases of such transformations in the automotive and healthcare industries. This paper, initially prepared as an internal research guide for Maestral Solutions machine learning and IoT teams, is to be used as a proposal document for potential new projects or research areas.

About Maestral Solutions

Maestral Solutions is a product development company that builds premium software and has enjoyed doing so since 2010.

Our C-suite experience and 113 experts on board, makes Maestral team more than ready for simplifying complex problems into scalable and flexible solutions ideal for driving your business further than ever.

A deep understanding of what is essential to delivering software using distributed teams is our greatest strength. In a sea of options, Maestral Solutions is an excellent partner to get things done.

INTRODUCTION

Machine learning and IoT are not niche markets any more. Many companies and industries are embracing technology and looking for opportunities that will enhance their business. The automotive industry is no exception.

There are many opportunities for machine learning in the automotive industry beyond self-driving and cognitive vehicles. Together, IoT and machine learning can take projects to the next level. IBM states “Cognitive IoT, AI and machine learning enable enterprises to unlock IoT value.” [8]

McKinsey , among others, estimates the IoT market size to increase to over $3.7B by 2020. [2] Business Insider expects that by 2020, 34B devices will be connected to the Internet, and consequently many of these devices will generate useful data. [1] Thus, our research concludes that there are potential projects with both our existing and new clients.

PROBLEM

As with other industries, IoT projects built for the automotive and healthcare industries generate significant amounts of data. What companies do with this ever growing mound of data and how they may use it to increase the value of projects is at the crux of the problem. The challenge is determining the best way to leverage this data.

With proper machine learning models, this previously untapped data can provide valuable information. Therefore, in order to reap the most value from IoT projects, companies should use machine learning as a tool to discover meaningful insights.

SOLUTION

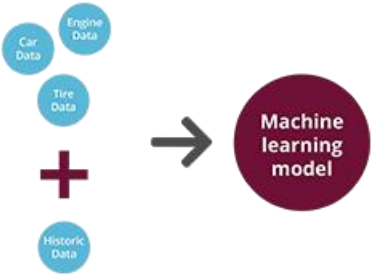
With proper machine learning model, we could turn previously untapped data into useful information. It is recommended that companies initiate a wave of complementary machine learning projects that would put data to use. To attain the greatest value of IoT projects and generate tangible results it is a must for companies to explore machine learning.

Predictive maintenance use case

Machine learning models are great for predicting results. If data sets are good, models can make predictions with a high degree of confidence. One specific use case is to use machine learning to predict car performance (or lack of it).

Humans are pretty good at predicting what is going to happen when their car's engine runs out of oil. However, modern cars have thousands of parameters that can affect car performance or cause future failures or malfunctions. Just like the Formula 1 case study, modern cars generate a lot of data. [9] The amount of data is too great for a human to utilize.

With machine learning models, data received from car sensors can be processed in real time to make predictions about the car's performance.



Leveraging supervised learning to train a model is the ideal approach. Based on the pool of already collected car performance data, we can train the model to predict the next failure or estimate a number of days before an incident. Once the model is trained and tested, we can develop a system that would gather real time data from the car and warn the driver of potential failures.

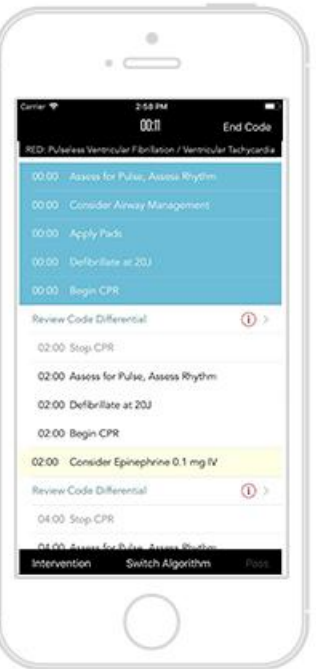
The model itself would be based on typical machine learning models, where predicting days would be a regression algorithm and predicting percentage of failure certainty would be a classification algorithm.

An additional question is identifying the platform that would host the solution. There are multiple platforms where such a model can be offered. For example, AT&T provides an automotive services delivery platform called AT&T DRIVE , that might be a good candidate. [7]

To conclude, the predictive maintenance challenge can be addressed with reading sensor data taken from the car itself. Machine learning models learn to process the data so the model warns the driver about potential failures.

Critical Care Management

The healthcare sector, just like automotive, provides ample examples of IoT - machine learning integration. Just like a car, humans can generate a lot of data. Maestral Solutions is currently working on the Code Runner project. The Code Runner project is a platform that provides assistance in critical-care management.
The platform helps doctors with a built-in algorithms that work to ensure efficient management of care of cardiopulmonary arrests, pediatric emergencies, and acute strokes. [13]



The algorithms are currently developed by doctors to help clinicians do the right procedure at the right time in order to maximize positive outcomes for patients. After each procedure, the system collects data related to the procedure. The platform collects the results of the process and patient demographics, along with all steps taken during the procedure.

This platform can be further enhanced with developing a machine learning model that would continually enhance the existing algorithms based on newly acquired data. Unsupervised learning could be used to cluster patient data based on health situation, algorithm implemented and survivability rate. In this way, the value and effectiveness of the platform would increase in nn automated fashion over time.

Maestral Solutions Development process

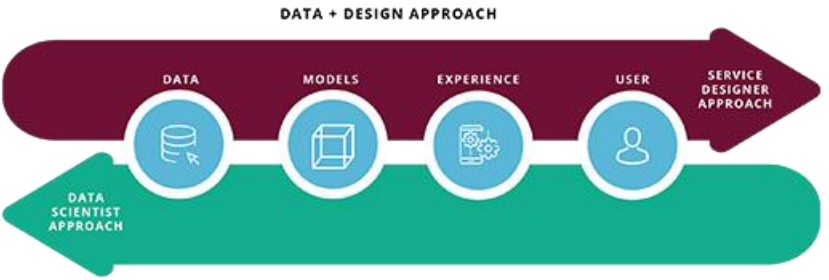
Maestral Solutions employs agile development methodologies for all engagements. Due to the interconnection of various steps, machine learning engagements utilize Kanban. Project teams are structured as self sufficient agile pods consisting of the disciplines required to complete the engagement.

Machine learning engagements use either Python or Java as a programming language along with the following technologies:

1. Tensorflow or Keras for deep learning,
2. Scikit-learn library for general purpose machine learning or
3. Apache Spark MLib for distributed programming.

For big data projects we use Apache Spark as a library for processing and manipulation of data.

Apache Kafka is used for real time data pipelines and streaming applications.
Maestral Solutions can use a range of machine learning services and solutions to build anddeploy big data analytics applications quickly and easily on Amazon.



Related Project Work

Maestral Solutions is experienced in working with machine learning and IoT. The following two projects are examples of related project work.

Measuring Employee Satisfaction Using Slack Data and Semantic Analysis

Maestral undertook an effort to determine employee satisfaction by analyzing Slack usage data. The objective of the project was to determine likely turnover by identifying employee disengagement. The hypothesis stated that employee engagement correlates strongly with the level of job satisfaction. Additionally, there is an inverse correlation between job satisfaction and turnover risk. Therefore, as job satisfaction decreases, the likelihood of turnover increases.

The project leveraged both Topic Modeling and Anomaly Detection algorithms to identify user disengagement. PowerBI was used for data visualization. The process followed is depicted below.

Specific details about the project can be found on the following blog post . [14]

Connected Vehicle

Maestral takes a UX Centric approach to building front end solutions that manage, control and monitor connected devices. Maestral was instrumental in designing and building portal solutions that allow OEMs, dealers and drivers to remotely manage vehicle services.

Additionally, Maestral applied this UX Centric approach toward designing and building a head-unit concept for a client. The head-unit is a physical LCD display located in the dashboard of the automobile. Maestral designed both the foundational platform running within the head-unit and multiple applications hosted within the platform. These applications could interact with the vehicle's telematics, as well as external security and automation solutions.

Conclusion

There are many opportunities to leverage machine learning within the IoT space. IoT sensors and actuators generate a tremendous amount of data. By tapping into this data, machine learning models can help companies gain meaningful insights, increase the value of solutions and possibly create additional service offerings for customers.

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