

Learning to Estimate Travel Time for Intelligent Transport Systems using online Machine Learning Algorithms (1)

(co-supervised by Eng. Yasmine Adel)

Project Overview:

Vehicle travel time estimation or estimated time of arrival (ETA) is one of the most important location-based services (LBS). It is becoming increasingly important and has been widely used as a basic service in navigation systems and intelligent transportation systems.

Online machine learning is a method of machine learning in which data becomes available in a sequential order and used to update our best predictor for future data at each step. The fact that the dataset is always varying in size within time arise to the need of online machine learning. Online Machine-learning algorithms adapt to train models continuously as soon as new data is available.

The main aim of the proposed project is to apply online machine learning algorithms to predict the vehicle travel time.

Eligible Departments:

Electronics	-
Communications	-
Networking	X

Software/Hardware:

C programming language

Traffic flow Prediction for Intelligent Transport Systems using online Machine Learning Algorithms

(co-supervised by Eng. Yasmine Adel)

Project Overview:

Traffic flow prediction is an important component of the autonomous driving system and used for traffic management and public safety. The traffic flow prediction is affected by many complex factors, such as inter-region traffic, events, and weather.

Online machine learning is a method of machine learning in which data becomes available in a sequential order and used to update our best predictor for future data at each step. The fact that the dataset is always varying in size within time arise to the need of online machine learning. Online Machine-learning algorithms adapt to train models continuously as soon as new data is available.

The main aim of the proposed project is to apply online machine learning algorithms to predict traffic flow.

Eligible Departments:

Electronics	-
Communications	-
Networking	X

Software/Hardware:

-Python

Implementing a Malware Testing Cloud Environment

(co-supervised by Eng. Youmna Atef)

Project Overview:

In this project we aim to build a malware detection system on our cloud Infrastructure through the following steps:

- Build different server models on the cloud (vmware vsphere cloud).
- Implement a code that gathers the server's readings metrics (on ESXI hypervisor).
- Download malware libs and execute them on safe isolated vm environment.
- Recollect the servers' reading after each attack.

Eligible Departments:

Electronics	-
Communications	-
Networking	X

Software:

- Python
- Vmware Vsphere 6.7
- Linux Redhat

Implementing a Machine Learning Algorithm (Anomaly Detection KNN) to detect malware in Cloud Environments

(co-supervised by Eng. Youmna Atef)

Project Overview:

In this project you are asked to implement a python code that performs anomaly detection using the K-nearest neighbor technique. The algorithm should build a normal model for the server's performance and detect the abnormality once a malware is injected on the system. We aim to optimize the training time and the complexity of the algorithm while lowering the average false positive rate of detecting an abnormal behavior when in fact there were no abnormalities on the system. Finally we will need to implement the algorithm on the hypervisor level.

Eligible Departments:

Electronics	-
Communications	-
Networking	X

Software/Hardware:

- Python
- VMware Vsphere 6.7
- Linux Redhat

Digital Twinning for Industry 4.0: Implementing an online dashboard for tracking System's events

(co-supervised by Dr. Eman Azab)

Project Overview:

In this project it is required to implement an online dashboard which reflects the current system status for an industrial factory. First it is required to build a model for the factory to resemble the machines and production lines using pre-implemented sensor modules that send data reflecting the machine's status. Data should be collected and stored in a cloud-based database. In the second phase the collected data should be used to implement a digital twin of the factory that is able to reflect all its live updates.

Eligible Departments:

Electronics	-
Communications	-
Networking	X

Software/Hardware:

- Flutter
- Arduino

Digital Twinning for Industry 4.0: Big Data Warehousing for Data-Driven Modeling

Project Overview:

Data Driven Modeling (DDM) is a technique where model components are dynamically injected into the model based on the data derived from external systems. In this project it is required to build a data warehouse for an industrial entity that stores all its data in an efficient manner to ease the process of data queries, analysis and decision making. In addition, data warehouse should be integrated with the digital twin of the system to display all its updates.

Eligible Departments:

Electronics	-
Communications	-
Networking	X

Software/Hardware:

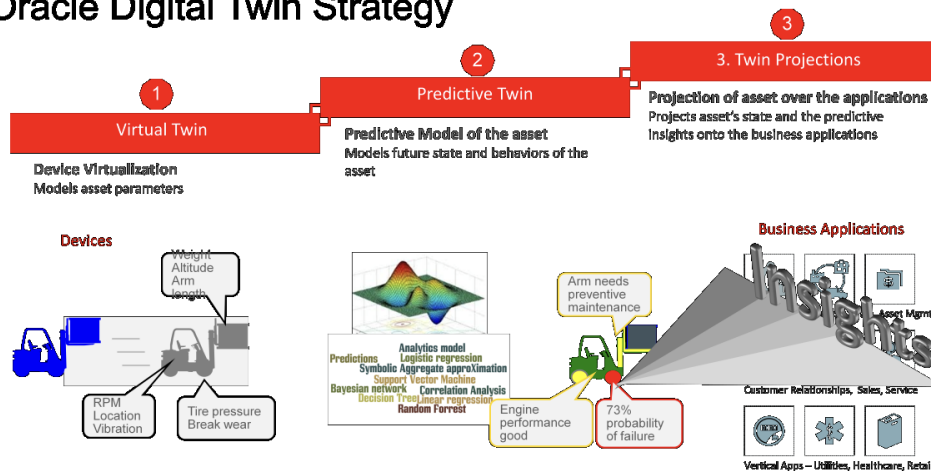
Hadoop / R

Digital Twinning for Industry 4.0: Virtual Twin Implementation

Project Overview:

A **Digital Twin** is defined as a virtual representation of a physical asset enabled through data and simulators for real-time prediction, monitoring, control and optimization of the asset for improved decision making throughout the life cycle of the asset and beyond.

Oracle Digital Twin Strategy



As per oracle's strategy on implementing digital twins, it is composed of three elements. In this project it is required to implement a Virtual Twin, by creating a virtual representation of a physical asset or a device in the cloud.

Eligible Departments:

Electronics	-
Communications	-
Networking	X

Software/Hardware:

- Fluttera
- Arduino

Relevant References:

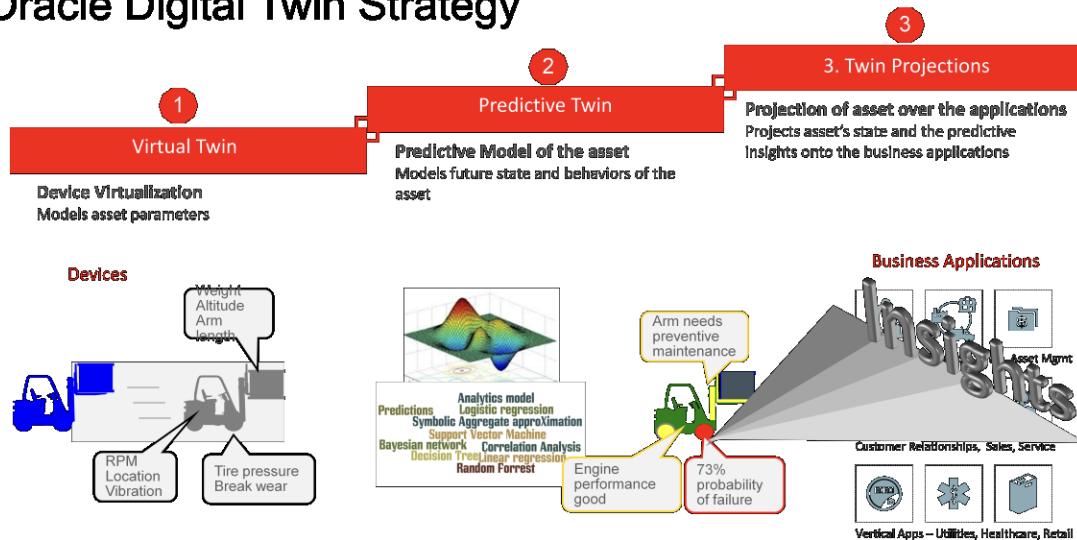
<http://www.oracle.com/us/solutions/internetofthings/digital-twins-for-iot-apps-wp-3491953.pdf>

Digital Twinning for Industry 4.0: Predictive Twin Implementation

Project Overview:

A **Digital Twin** is defined as a virtual representation of a physical asset enabled through data and simulators for real-time prediction, monitoring, control and optimization of the asset for improved decision making throughout the life cycle of the asset and beyond.

Oracle Digital Twin Strategy



As per oracle's strategy on implementing digital twins, it is composed of three elements. In this project it is required to implement a Predictive Twin, by implementing data driven hybrid models operating on the virtual twin to predict the behavior of the physical asset.

Eligible Departments:

Electronics	-
Communications	-
Networking	X

Software/Hardware:

- Python

Relevant References:

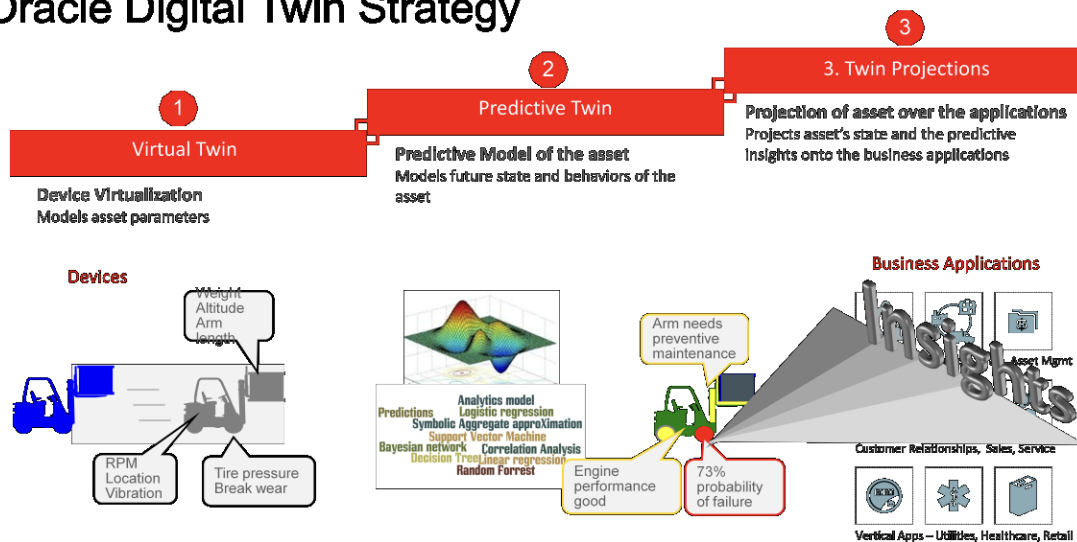
<http://www.oracle.com/us/solutions/internetofthings/digital-twins-for-iot-apps-wp-3491953.pdf>

Digital Twinning for Industry 4.0: Twin Projection Implementation

Project Overview:

A **Digital Twin** is defined as a virtual representation of a physical asset enabled through data and simulators for real-time prediction, monitoring, control and optimization of the asset for improved decision making throughout the life cycle of the asset and beyond.

Oracle Digital Twin Strategy



As per oracle's strategy on implementing digital twins, it is composed of three elements. In this project it is required to implement the Twin Projection, which is the integration of insights generated by the predictive twin into the Business operation and processes.

Eligible Departments:

Electronics	-
Communications	-
Networking	X

Software/Hardware:

- Python

Relevant References:

<http://www.oracle.com/us/solutions/internetofthings/digital-twins-for-iot-apps-wp-3491953.pdf>

Empowered Edge: Performance Evaluation of Edge Computing Nodes in Mobile Edge Cloud (1)

(co-supervised by Eng. Ahmed Hamza)

Project Overview:

Empowered edge is a term in IT that is used to talk about empowering computing centralization that is distributed toward the edge of a network, toward the end user and the end user device. It is a key concept in device management in the cloud and big data age. It is also one of Gartner's top 10 strategic tech trends in 2020.

In this project it is required to model the cloud-edge system as a queuing system and analyze its performance using queuing analysis.

Eligible Departments:

Electronics	-
Communications	-
Networking	X

Software/Hardware:

- Matlab
- Java Modelling Tool

Relevant References:

<https://stefanini.com/en/trends/news/gartner-top-10-strategic-tech-trends-in-2020-empowered-edge>

Empowered Edge: Performance Evaluation of Edge Computing Nodes in Mobile Edge Cloud (2)

(co-supervised by Eng. Ahmed Hamza)

Project Overview:

Empowered edge is a term in IT that is used to talk about empowering computing centralization that is distributed toward the edge of a network, toward the end user and the end user device. It is a key concept in device management in the cloud and big data age. It is also one of Gartner's top 10 strategic tech trends in 2020.

In this project it is required to implement an OMNeT++ model for the cloud-edge system to analyze its performance and compare it to theoretical analysis performed in the other part of the project.

Eligible Departments:

Electronics	-
Communications	-
Networking	X

Software/Hardware:

- OMNeT++

Relevant References:

<https://stefanini.com/en/trends/news/gartner-top-10-strategic-tech-trends-in-2020-empowered-edge>

Dynamic Scheduling for Industry 4.0 Systems using Artificial Intelligence: A Case Study (1)

Project Overview:

Scheduling is a common task that needs to be frequently performed in all Industrial systems. It is initially performed and repeated again whenever the system encounters any update. Scheduling is typically performed using existing meta-heuristic methods as Genetic algorithm. In this project it is required to test different AI approaches that can be used for the scheduling process, implement them and compare their results to the basic scheduling methods already implemented in earlier stage of the project.

This project is a continuation of an Industrial cooperation with one of the biggest pharmaceutical companies in the middle-east.

Eligible Departments:

Electronics	-
Communications	-
Networking	X

Software/Hardware:

- Python

Dynamic Scheduling for Industry 4.0 Systems using Artificial Intelligence: A Case Study (2)

Project Overview:

Scheduling is a common task that needs to be frequently performed in all Industrial systems. It is initially performed and repeated again whenever the system encounters any update. Scheduling is typically performed using existing meta-heuristic methods as Genetic algorithm. In this project it is required to test different AI approaches that can be used for the scheduling process, implement them and compare their results to the basic scheduling methods already implemented in earlier stage of the project.

This project is a continuation of an Industrial cooperation with one of the biggest pharmaceutical companies in the middle-east.

Eligible Departments:

Electronics	-
Communications	-
Networking	X

Software/Hardware:

- Python

Performance Analysis of Manufacturing Systems using Queuing Theory for Industry 4.0

Project Overview:

Manufacturing is the application of tools and a processing medium to the transformation of raw materials into finished goods. For the design or improvement of manufacturing systems it is important to be able to predict their performance, and the most accurate way for doing this is using Queuing Theory. In this thesis it is required to conduct a literature review on how manufacturing system can be modeled and analyzed using queuing theory, and implement a simple and basic system to have a full understanding on how it works and how to perform its analysis.

Eligible Departments:

Electronics	-
Communications	-
Networking	X

Software/Hardware:

- Matlab
- Java Modelling Tool

References:

<https://pure.tue.nl/ws/files/1782068/200710449.pdf>