**Predicting Shop Floor Occupancy**

**Overview**

Contoso Corporation is a construction company building shop floors for many manufacturers across the United States. They are interested in incorporating sustainability into their shop floor design as they embark on smart building development. To support this effort, Contoso has invested in IoT technology, installing sensors on 51 of their shop floors. As a launching ground for their sustainability journey, Contoso needs to understand the data collected by their sensors and the factors influenced by the occupancy rate. Using this knowledge, they want to regulate temperature, humidity, light, and monitor CO2 levels on their shop floors.

**This hackathon enables attendees** to access the data Contoso has collected from their sensors to predict if a room does or does not have any occupants. The dataset contains a week’s worth of records (UNIX Epoch) for each of the 51 shop floors. This data includes information about CO2 concentration, humidity, room temperature, and luminosity.

The dataset has been obfuscated to prevent any leak of IP or identities from prior analysis, and thus the column variables will be general in nature.

**During the “hacking” attendees will focus on** understanding the data, searching for trends, exploring correlations, the characteristics and impact between C02, temperature, humidity, light and occupancy rate. Hackers will determine which of these collected features could potentially help in determining if a shop floor is occupied.

**This hackathon enables attendees to** help identify which type of data collected could prove most beneficial in the development of smart buildings.

**This hackathon simulates a real-world scenario** where a construction company is striving to incorporate sustainability in future shop floor designs.

**By the end of the hackathon**, attendees will have built a classification model to predict if a shop floor is occupied.

**Technologies**

* A web browser
* A Microsoft account
* A Microsoft Azure subscription – that would be provided
* A Windows, Linux, or Mac OS X computer
* Python
* Azure Machine Learning Studio (Auto ML, Designer can also be used for this challenge but not necessary)
* Jupyter notebooks

**Prerequisites**

**Knowledge Prerequisites**

To complete the challenges, participants will need background knowledge of the following:

* Python
* Azure Machine Learning Studio (Auto ML, Designer can also be used for this challenge but not necessary)
* Jupyter notebooks
* Basic Data Science Knowledge: Data Exploration and Classification model building (Relevant prep materials: [Create machine learning models - Learn | Microsoft Docs](https://docs.microsoft.com/en-us/learn/paths/create-machine-learn-models/))

#### **Other basics would be:**

* A web browser
* A Microsoft account
* A Microsoft Azure subscription – that would be provided
* A Windows, Linux, or Mac OS X computer
* The challenge files for this course

#### **Links & Resources for Post Learning Recommendations**

#### Sustainability Resources:

#### Sustainability FAQs: [FAQ (sharepoint.com)](https://microsoft.sharepoint.com/sites/sustainability/sitepages/faq.aspx)

#### MSX Content: <https://aka.ms/MSUSSustainability>

* Sustainability Hub: <https://microsoft.sharepoint.com/sites/sustainability/>

#### Environmental Priorities- Carbon: <https://microsoft.sharepoint.com/sites/sustainability/SitePages/Program-Carbon.aspx>

#### Environmental Priorities-Ecosystems: <https://microsoft.sharepoint.com/sites/sustainability/SitePages/Ecosystems.aspx>

* Data Science:
* Azure Machine Learning: <https://docs.microsoft.com/en-us/azure/machine-learning/>
* Data Exploration and Model building: [Create machine learning models - Learn | Microsoft Docs](https://docs.microsoft.com/en-us/learn/paths/create-machine-learn-models/)

**Challenges**

**Challenge 1: Load the data set to Azure Machine Learning Workspace**

A sophisticated data-collection device, the sensor is a crucial and fascinating component of the Internet of Things (IoT). The purpose of sensors is to collect analog data from the physical world and translate it into digital data assets. Sensors are measuring just about any aspect of the physical world. The calibration of sensors allows them to be tailored to application-specific functions. In this dataset, sensors have been calibrated to measure temperature, humidity, Co2 concentration, luminosity and PIR (motion detection) with accuracy. This sensor data is tasked with capturing information relevant to a shop floor design, so the data can be used to make process improvements for the purpose of increasing carbon and energy efficiency in shop floors.

This challenge is designed to achieve following learning objectives:

* How is sensor data collected in Azure Blobs?
* How to ingest and wrangle the data to generate insights from it?

**Challenge 2: Data Exploration**

Data exploration is an approach to understand what is in a dataset and the characteristics of the data. These characteristics can include size or amount of data, completeness of the data, correctness of the data, possible relationships amongst data elements or files/tables in the data. Data Exploration is aimed at understanding the nuances of the data, and defining basic metadata (statistics, structure, relationships) for the data set that can be used in further analysis.

This challenge is designed to achieve following learning objectives:

* What are the ways data can be pruned or refined by removing unusable and poorly formatted data portions?
* How to visualize relevant relationships amongst features across dataset?

**Challenge 3: Build a classification model to predict if a shop floor has occupants**

A machine learning model is a file that has been trained to recognize certain types of patterns. You train a model over a set of data, providing it an algorithm that it can use to reason over and learn from those data. Once you have trained the model, you can use it to reason over data that it hasn't seen before and make predictions about those data.

This challenge is designed to achieve following learning objectives:

* What machine learning models are suitable for this and similar problem statements?
* How to interpret how the machine learning models are tuned to predict future unseen data?

**Value Proposition**

* Develop fluency in sustainability topics especially in carbon and energy space to have meaningful conversations with customers and partners
* Join the community of Microsoft Sustainability Champions and get badged

**Technical Scenarios**

* Environmental Monitoring​
* Energy consumption / embodied carbon monitoring and reporting​
* Facilities/equipment operating efficiency optimization​
* Energy source optimization

**Audience**

* Facilitator/Proctor: ATU, CSU, STU, SMC, OCP, CSA
* Student: CSA, CSU

# **Market Roadmap**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **Goals** | **Opportunity** **Areas** |
| **Carbon /**  **Energy** |  | * Reduce total & per capita energy consumption * Reduce GHG emissions, Scope 1-3 * Increase contribution of Green Power in total power consumption * Energy & grid management | * Monitor power consumption across operations * Monitor CO2 emissions across operations * Monitor embodied carbon * Monitor & manage carbon in supply chain * Environmental monitoring & reporting * Optimize energy sourcing and supply chain |
| **Ecosystem / Real Estate** |  | * Reduce energy and electricity consumption by facilities and infrastructure * Green Building Ecosystem * Reduce environmental impact on natural ecosystems, including species biodiversity, land / agriculture etc. | * Monitoring building efficiency * Monitor forests, lands, species * Assess environment impact |

Sustainable cloud positions companies to deliver on new commitments: carbon reduction and responsible innovation. Companies have historically driven financial, security, and agility benefits though cloud, but sustainability is becoming an imperative.

|  |  |  |
| --- | --- | --- |
| **44%** | **|** | of CEOs in the United Nations Global Compact – Accenture Strategy CEO study on Sustainability see a net-zero future for their company in the next ten years. |
| **4.7X** | **|** | Between 2013-2019, companies with consistently high environmental, social and governance (ESG) performance enjoyed 4.7X higher operating margins and lower volatility than low ESG performers over the same period. |
| **30-40%** | **|** | Migrations to public cloud result in up to 30-40% total cost of ownership (TCO) savings. |

Drivers like greater workload flexibility, better server utilization rates, and more energy-efficient infrastructure all make public clouds more efficient than enterprise-owned data centers.

**Competitive Landscape**

* **Salesforce**: <https://www.salesforce.com/products/sustainability-cloud/overview/>
* **AWS**: <https://sustainability.aboutamazon.com/environment/the-cloud#:~:text=Sustainability%20in%20the%20Cloud%20Amazon%20Web%20Services%20%28AWS%29,100%25%20renewable%20energy%20usage%20for%20our%20global%20infrastructure>.
* **Google**: <https://sustainability.google/>

**FAQs**

#### Sustainability FAQs: [FAQ (sharepoint.com)](https://microsoft.sharepoint.com/sites/sustainability/sitepages/faq.aspx)