

R&D interview exercise

Development Knowledge Base

Exported on 09/16/2024

Table of Contents

1	Step 1: Learning	4
2	Step 2: Optimisation	5
3	Submitting	6
3.1	Extras	6

The objective of the exercise is to:

1. Learn the power usage of physical machines as a function of 3 inputs
2. Formulate and solve an optimization problem to reduce the overall power consumption of the machines running together, and save energy

1 Step 1: Learning

Datasets for 2 machines types have been provided, comprised of:

- 3 inputs columns
- 1 output column: power usage of the machine
- 1 'check' column: value that indicate whether the row is valid or not

For each machine independently, find a model that fits the power as a function of the 3 inputs, with the following instructions:

- Only include rows with a 'check' value between 90 and 110
- Any type of Machine Learning or statistical modeling technique can be used
- Different techniques can be used for each machine or both can use the same technique. It's up to you.
- Present your results:
 - Include at least 1 metric of your choice to quantify the accuracy of the predicted power, compared to the actual power from the dataset
 - Include at least 1 graph to illustrate the results
 - Write a few lines in plain English to explain your methodology and interpret the results

2 Step 2: Optimisation

- Scenario: 20 machines are running in parallel in a factory to produce goods. Each machine can produce a different number of Goods Per Hour (GPH), and their power usage varies based on this GPH number. We want to find the GPH for each machine that results in the target total GPH for the factory while consuming the lowest power possible.
- There are 20 machines in the factory:
 - 10 instances of machine type #1
 - 10 instances of machine type #2
- The power usage as a function of GPH is determined for each machine by the model you defined and learnt in Step 1, where the GPH is Input 3
- Parameters:
 - Input 1: static value set to 25
 - Input 2: static value set to 6
 - Input 3: GPH or goods per hour. This is a variable, that can be varied within limits:
 - Machine type #1: can produce between 180 - 600 GPH
 - Machine type #2: can produce between 300 - 1,000GPH
 - The target total GPH for the factory is 9,000 GPH
 - This is the sum of the 20 machines GPH
- Objective: Find the GPH value for each machine that brings the lowest total power, with all machines enabled, and meets the target total GPH of 9,000.
- Present your results:
 - Include the optimal GPH value for each machine
 - Include the total power of the 20 machines together
 - Write a few lines in plain English to explain your methodology and interpret the results

3 Submitting

- You are free to use any Python Libraries or tools you wish.
- Your solution should be submitted as a GitHub repository or similar that Conserve It can access, download and run. A private repository shared with your interviewers would be preferred.
- A Readme file should be included giving instructions on any setup required to run the solution. As well as stating any assumptions, limitations or rational for any decisions made.
- A brief summary presentation of your approach and results should be included with the submission, this may either be a separate document or included inline with your solution if a notebook is used.
- Only the above readme, the summary and any files required to run your solution are required for submission.

3.1 Extras

- all Extras are optional
- Give a special focus on computing resources to find the optimal solution of Step 2 , for it to be as quick as possible
- Include an export of any modelling you have completed in a method that could be re-used by another program without re-training if applicable.
- Provide a method for a user to be able to run your solution with configurable machines running, input_1 and input_2 values and target GPH.
- provide multiple different approaches to modelling with a comparison of the various models.