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Study of delay prediction in the US airport network

Document:

Budget report

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Degree:

Master in technology and engineering management

Examination session

Autumn, 2022 - 2023

MASTER FINAL THESIS



Table of Contents

1	Introduction	1
2	Budget	2
2.1	Labour costs	2
2.2	Computation costs	4
2.3	Total costs	5



List of tables

2.1	Cost breakdown between student and supervisor	2
2.2	Task breakdown for the supervisor	3
2.3	Task breakdown for the student	3
2.4	Specifications of the computer used to develop code	4
2.5	Specifications of the computer used to write thesis	4
2.6	Cost breakdown for computation and electricity	4
2.7	Cost breakdown for computation and electricity	5



Chapter 1

Introduction

In this document the economic overview of the master thesis titled: "Study of delay prediction in the US airport network" is elaborated. All the costs related to this study are calculated and presented in this study, the costs are broken down into labour costs and computation costs to run scripts.

Chapter 2

Budget

This chapter gives an overview of the budget and costs required to execute the tasks involved in the master thesis study. The costs are categorized into labour costs and into computation or electricity costs.

2.1 Labour costs

The first cost category is labour costs. During the project, a student has been working on the labour tasks, together with supervision and advice from the thesis advisor, a professor from the staff of the university. The labour costs for the student account for the total hours spent on the project, multiplied by the salary of a junior data scientist. The labour costs for the supervision of the professor account for the hours spent on supervision multiplied by the salary of a university professor. Table 2.1 shows the total labour cost breakdown between the student and the professor. Table 2.1 shows that the labour costs for the student account for 11250€ and the labour costs for the supervisor account for 1500€, which comes to a total of 12750€ in labour costs.

Table 2.1: Cost breakdown between student and supervisor

Employee	Average hourly salary [€/hour]	Total hours	Total cost
Student	15	750	11250€
Supervisor	30	50	1500€
Total costs			12750€

The total number of hours spent on the project can be broken down into several tasks for both the supervisor as well as for the student. For the supervisor, the tasks can be broken down into reviewing, processing feedback, and giving advice, these tasks apply both to code and the report. The breakdown of hours spent on each task by the supervisor is given in table 2.2. The total time for the supervisor accounts for 50 hours.

Table 2.2: Task breakdown for the supervisor

Task type	Task description	Total hours
Code and programming	Reviewing R code	15
	Processing code feedback	5
	Advising and consulting on R code and structure	5
Documentation	Reviewing thesis report	15
	Processing feedback on thesis report	5
	Advising on thesis and structure	5
Total hours		50

A breakdown of each task with the corresponding time required for the student is given in table 2.3. The tasks for the student can be broken down into two task types, tasks related to writing code in R and programming, and tasks related to documentation and writing the thesis report. The total time for the student accounts for 750 hours.

Table 2.3: Task breakdown for the student

Task type	Task description	Total hours
Code and programming	Code architecture	15
	Data pipeline architecture	40
	Flight data processing	30
	Weather data processing	30
	Feature engineering	40
	Custom cross-validation functions	40
	Custom model tuning functions	40
	Final model pipeline	30
	Model metric extraction	30
	Refactoring code	100
	Code version management	30
	Unit testing code	50
	Code verification in development	40
Processing supervisor feedback in code	40	
Total hours worked on code and programming		555
Documentation	Thesis structure	15
	Introduction writing	15
	Literature study writing	30
	Methodology writing	30
	Results writing	30
	Conclusions writing	20
	Maintaining bibliography	20
	Drafting diagrams	25
Drafting budget document	25	
Total hours worked on documentation		195
Total hours		750

2.2 Computation costs

The second cost category is the costs for computation, which are mainly derived from electricity. The software used to develop the code is RStudio, which is open-source and free. The computer used to develop the code is owned by the student and therefore no additional costs were made. A separate computer was used to write the report, since, when the scripts are running no other operations on the computer was possible due to the excessive random access memory usage of the code or script. Therefore only the costs of running the computers are calculated, which can be derived from the costs of electricity in Spain. The specifications of the computer used to develop the code are given in table 2.4. The computer is a Asus GL553V. The computer has a power consumption of 120 W.

Table 2.4: Specifications of the computer used to develop code

Part type	Information	Additional information	Comment
Processor	Intel Core i7-7700HQ	2.8 GHz clock	Up to 3.8GHz
Graphics card	NVIDIA GTX 1050	2 GB memory	N/A
RAM	16 GB memory	N/A	N/A
Operating system	Linux	Ubuntu	Version 20.04 LTS
Power consumption	120W	N/A	N/A

The specifications of the computer used to write the documentation and the thesis is given in table 2.5. The computer is a Dell precision 3570. The computer has a power consumption of 90 W.

Table 2.5: Specifications of the computer used to write thesis

Part type	Information	Additional information	Comment
Processor	Intel Core i7-1255U	1.7 GHz clock	Up to 4.7GHz
Graphics card	No dedicated GPU	N/A	N/A
RAM	32 GB memory	N/A	N/A
Operating system	Windows	Version 10	Enterprise edition
Power consumption	90W	N/A	N/A

Given the power consumption of both computers, it is possible to calculate the total electricity costs using the cost of electricity per kWh. The average cost of electricity in Spain during the project was 0.20€ per kWh. The total costs for computation and electricity is summarised in table 2.6.

Table 2.6: Cost breakdown for computation and electricity

Computer	Power consumption [kW]	Hours used	Total cost
Programming	0.09	555	9.99€
Documentation	0.12	195	4.68€
Total costs			14.67€

2.3 Total costs

Using the calculation of the total labour costs in table 2.1 and the total computation and electricity costs in table 2.6, the total costs of the project can be calculated. The calculation of the total costs is shown in table 2.7, the total costs come down to 12764.67€.

Table 2.7: Cost breakdown for computation and electricity

Cost type	Costs [€]
Labour costs	12750€
Electricity costs	14.67€
Total costs	12764.67€