



UNIVERSITÀ DEGLI STUDI DI TRIESTE  
DIPARTIMENTO DI MATEMATICA E GEOSCIENZE

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MASTER COURSE IN  
DATA SCIENCE AND SCIENTIFIC COMPUTING

# Optimizing fault search in power grid outages through Reinforcement Learning

CANDIDATE:

Angela Carraro

SUPERVISOR:

Antonio Celani, ICTP

CO-SUPERVISORS:

Andrea Zancola, AcegasApsAmga

Luca Bortolussi, UniTS

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# Abstract

Riassunto in italiano.



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# Chapter

# 1

## Introduction

### 1.1 The problem

AcegasApsAmga S.p.A. is a company based in Trieste and subject to the direction and coordination of Hera S.p.A., called also Hera Group, which is a multiutility company based in Bologna, Italy. Hera operates in the distribution of gas, water, energy, and waste disposal in some Italian provinces.

The project involves Trieste power grid.

### 1.2 The power grid

Describe the power grid and all its elements.





# Part I

## Data Management



# Chapter

2

## Data Management

### 2.1 Introduction

### 2.2 Raw to bronze

### 2.3 Bronze to silver

#### 2.3.1 The circuit graph

#### 2.3.2 The electrical graph

#### 2.3.3 The substations graph



# Chapter

# 3

## Data Collection

### 3.1 The Telegram bot

### 3.2 Synthetic Data Generation

Synthetic data is “any production data applicable to a given situation that are not obtained by direct measurement” according to the McGraw-Hill Dictionary of Scientific and Technical Terms.

Given the total lack of data, I had to create them. We decided to use a Telegram bot which uses AWS to present to the technicians possible scenarios so to have record of what they would do to solve the power outage.



# Part II

## Algorithms





## Reinforcement Learning: Dynamic Programming

### 4.1 Introduction

As described in [1], Reinforcement Learning is an area of Machine Learning that analyzes how an agent can learn which actions to take in an environment based on some given reward. So the agent is not told which actions to take, but learns by trial-and-error which are the ones that leads to a bigger reward.



**Chapter**

**5**

# **Linear programming**



# **Part III**

## **Finance**



## Chapter

## 6

# Automazione cabine

Dato il modello che simula la risoluzione del guasto e calcola il suo costo, aggiungi una simulazione aggiungendo una cabina telecomandata e vedi di quanto diminuisce il costo.





**Chapter**

**7**

**Conclusion**



# Bibliography

- [1] Richard S. Sutton and Andrew G. Barto. *Reinforcement Learning: An Introduction*. MIT Press, Cambridge, Massachusetts (MA), 2018.