INSTITUTE OF COMPUTING SCIENCE
POZNAŃ UNIVERSITY OF TECHNOLOGY
FACULTY OF COMPUTING AND TELECOMMUNICATIONS

ENGINEERING DIPLOMA THESIS

What can data on testing and infection characteristic tell us about the coronavirus pandemic?

Hubert Braun
hubert.braun@student.put.poznan.pl

Kornelia Maik
kornelia.maik@student.put.poznan.pl

Patryk Wenz
patryk.wenz@student.put.poznan.pl

Kacper Wleklak
kacper.wleklak@student.put.poznan.pl

Supervisor:
Prof. Czesław Jędrzejek Ph. D. Eng.

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1 Introduction

During the ongoing situation of unpredictability and concern caused by the Coronavirus disease 2019 (COVID-19) outbreak, it is imperative to meticulously monitor the global spread of the virus and the impact clinical decisions have on maintaining control over the pandemic.

Europe has experienced a tremendous coronavirus transmission immediately after its global expansion outside China. Following the increase in number of infections and lethal cases, European countries have affected the lives of average citizens by implementing different interventions such as social distancing, school closures or lockdowns. These steps have been taken with the aim of reducing the virus' transmission rate by lowering the number of infections.

Since the beginning of the SARS-CoV-2 pandemic, many theses have been released regarding the virus transmission. Despite valuable work done on the subject of the virus spread, the enormous growth in number of infections and deaths that happened in the last quarter of 2020 has put the public in confusion and growing dismay. With the global stock market panic, increasing unemployment, experience of deaths in immediate family and mental health issues on the rise, the public has entered circumstances where there is little we are certain about. Studying the pandemic characteristics could lead to lessening the future losses by helping the governments in basing their decisions on known virus spread patterns and estimations of a given intervention effect.

In order to study the impact that different interventions have on the spread of the pandemic, many countries have united in the task of data gathering. Data from patients infected with SARS-CoV-2 are of immense value to the studies of the disease's characteristics and pandemic models. Estimating the spread of the virus requires knowledge on factors such as reported infections, fatality, contact patterns and suspectibility of a given population. Data concerning these and many other factors are accumulated in hospitals and often published as open datasets by country's officials. With the appliance of probability theorems, pandemic models based on such datasets have a growing potential of adequate virus spread estimation.

Based on the reported data, many ratios and indicators are defined and set to further study the factors effecting the transmission of COVID-19 in a geographical area. The percent positive or "positivity rate" is the number of positive tests divided by the total number of resulted reported tests. Data on

contact patterns and reported infections give insights on the basic reproduction number, a metric that describes the transmissibility of infectious agents by estimating "the number of secondary cases one case would produce in a completely susceptible population". Given the data on a population's immunity to the virus, a metric could be estimated named effective reproduction number, which takes into account a population that is only partly suspectible.