Name of the University
Name of the Faculty
Name of the Programme

RESEARCH PROJECT PROPOSAL

Name of Candidate: Applicant Full Name

Date of Admission to this programme: February 10, 2022

Full time mode

Abstract

Brief summary of the proposal and its sections.

1. Project Title

Communicate the key problem of the research in a brief sentence.

2. Introduction

The proposal length could vary, but four to seven pages are recommended in order to convince that the problem presented is relevant and could be studied and solved in the duration of the program and with the resources available.
The introduction consists of one or two paragraphs about the research problem, the related topics, the importance of the problem being studied or solved, the proposed methods to approach it, the relevance of the outcomes and their differences from the ones already existing.

3. Hypothesis

Write the hypothesis that will be tested in one sentence. This should guide the project objectives and research questions.

4. Project objectives and/or Research questions

- The two or three most important goals.
- Can be pointed in a list or a concise paragraph.

5. Background and related literature

Incorporate the background supporting the methodology and the recent studies for the research problem focusing in the main objectives or research questions.

6. Methodology

The study will focus in the **Monterrey Metropolitan Area (MMA) between 2018 and 2019**. The air quality samples in the are taken each hour from 13 sensors over the MMA that measure concentrations of **CO**, **NO**, **NO_2**, **O_3**, **SO_2**, **PM_{10}**, **$PM_{2.5}$**, and **atmospheric pressure**, **rainfall**, **relative humidity**, **solar radiation**, **temperature**, **wind velocity and direction**. This data is

provided by the *Sistema Integral de Monitoreo Ambiental de Nuevo León* (SIMA) [Sistema Integral de Monitoreo Ambiental (SIMA), Nuevo León, 2020]. The Mexican diseases data was obtained from the Mexican *Department of Health* [Secretaría de Salud, 2020] and contains information from all states and municipalities in Mexico such as **date of admission**, **egress date**, **age at the admission**, **gender**, **weight**, **height**, **ICD code upon arrived**, **ICD code upon diagnosed**, **reason of egress**.

The air quality data needs to be interpolated because it contains imputed records. Different temporal interpolation techniques are used and compared Friedman [1962]. Also, an spatio-temporal interpolation is performed to obtain the missing data values Li and Revesz [2002]. Both data sets are processed and converted to georeferenced time series Wei [2019] that are stationary Hyndman [2018] in order to establish their relationship by cross correlation Derrick and Thomas [2004], multiple regression analysis Brockwell [2002], vector autorregresive approaches, causality models Popescu and Guyon [2013] and geographic interactions Comber and Zeng [2019]. The results are ranked by metrics like R^2, the Akaike (AIC), and the Bayesian (BIC) information criteria Albert [2007]. Finally, it will be produced a web application that allow general and specialized population to interact with the data and obtain forecasts, interactions and visualizations of the models described.

7. Significance

While the Introduction mention the relevance of the research, here it need to be highlighted and demonstrated. Focus specially in the contributions that the results could bring to the state of the art and/or the solutions that can provide to the problems involved.

8. External Collaboration

If any, include authors, published papers, works in research programs or conferences where the research have been involved.

9. Project schedule

Add a schedule that includes the steps of the process, from investigation, possible publications and participation in conferences, to final products like thesis, libraries…A Gantt diagram is recommended.

References

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Timothy R. Derrick and Joshua M. Thomas. Innovative analyses of human movement, chapter Time Series Analysis: The Cross-Correlation Function, pages 189–205. Kinesiology Publications, 2004.

Milton Friedman. The interpolation of time series by related series. Journal of the American Statistical Association, 57(300):729–757, December 1962. doi: 10.1080/01621459.1962.10500812.

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Lixin Li and Peter Revesz. A comparison of spatio-temporal interpolation methods. In Geographic Information Science, pages 145–160. Springer Berlin Heidelberg, 2002. doi: 10.1007/3-540-45799-2_11.

F. Popescu and I. Guyon. Causality in time series. Microtome PublishingBrookline, 2013.

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