



Focusing maths of COVID-19 on South America

JUNE 4th 2020 – 1:00 to 3:00 pm

Applied mathematicians throughout the world have responded swiftly to the COVID-19 pandemics, integrating interdisciplinary teams and proposing models that help understanding the dynamics of the disease and its effects on society.

The webinar will give a panorama of such contributions in South America, where several teams have developed models specifically tailored to the local needs and reality.

Pablo A. Lotito

Affiliation: PLADEMA Fac. de Ciencias Exactas, UNCPBA & CONICET

Title: Some mathematical applications to COVID

Abstract: We will comment on some developments currently undertaken in Argentina related to the COVID disease, mostly based on compartmental models

Francisco Louzada Neto

Affiliation: ICMC, USP & CeMEAI

Title: Safety-Stock: Predicting the demand for supplies in Brazilian hospitals during the COVID-19 pandemic

Abstract: Under the COVID-19 pandemic scenario, a challenge is to predict the demand for hospital supplies, in particular for personal protective equipment (PPE), mitigating risk of stock-out. In this context, we develop naive statistical modelling, which combines historical data on the consumption of PPE by hospitals, current protocols for their uses and epidemiological data

related to the disease, to build predictive models for the demand for such supplies in Brazilian hospitals during the pandemic. We then embed our modelling in the free Safety-Stock expert system, that indicate the safety stock for a particular hospital. The Safety-Stock garnishes prediction of consumption/demand for PPE over time, indicating the moment when the hospital reaches maximum consumption, the estimate of how long it will work in this state, and when it will leave it. With our predictions, a hospital may have estimated, based on its stock levels and possible new purchases, its needs related to a specific PPE, which allows for the adoption of strategies to control and keep the stock at safety levels. As a direct consequence, it enables interchange and cooperation between hospitals, aiming to maximize the care during the pandemic.

Maurício Velasco

Affiliation: Universidad de los Andes in Bogotá

Title: Optimal pooling testing protocols and risk based quarantine

Abstract: In this short talk I will try to give an overview of two very different yet complementary ideas developed with various co-authors at Universidad de los Andes in Bogotá (Colombia). (1) We have found provably optimal protocols for pooled testing. These are methods to combine samples (from different persons) to detect disease using less reagents and less time without any loss in precision. This is a purely mathematical idea which can be applied to both active infection RT-PCR and ELISA antibody testing and can increase the testing capabilities of a country at zero investment. I will describe these testing mechanisms and explain in which sense they are provably optimal. This is joint work with Manu Forero and Juan Manuel Pedraza (UniAndes bio-physics) (2) We ask about sustainable alternatives to quarantine. We claim that if we ease quarantine by first releasing the low-risk population and only considerably later releasing the high-risk population (risk-based quarantine) then we can save a very significant number of lives in the way to immunity while having a functioning economy. We substantiate this claim via a deterministic compartment model and verify its robustness over a very wide range of parameters with simulations on the city of Bogotá. This is joint work with Florencia Reali (UniAndes psychology)

Paulo J. da Silva e Silva

Affiliation - IMECC, Unicamp & CeMEAI

Title: Robot dance: a city-wise automatic control of Covid-19 mitigation levels

Abstract: We develop an automatic control system to help to design efficient mitigation measures for the Covid-19 epidemic in cities. Taking into account parameters associated to the population of each city and the mobility among them, the optimal control framework suggests the level and duration of protective measures that must be implemented to ensure that the number of infected individuals is within a range that avoids the collapse of the health care system.

Pedro Gajardo

Affiliation - DMAT, Universidad Técnica Federico Santa María

Title: Modeling and analysis of mitigation strategies and their effects for the COVID-19 outbreak in Chile

Abstract: In this talk we will present our experience working in one of interdisciplinary groups in Chile whose objective is to provide information and tools for policy makers. From the beginning of March 2020 we have tried to understand the disease dynamics and model some mitigation strategies in order to analyze their effects and asses scenarios for lifting some measures. The focus of our analysis has been the demand of ICU beds and how different policies affect the maximal demand (in quantity and date). Lately we have analyzed dynamical lockdowns activated by some epidemiological indicators, proposing a methodology for determining what is the best indicator to use, in terms of its cost-effectiveness (producing lower peaks in epidemiological curves and less days in lockdowns), as a first attempt of considering the social and economic effects of implemented policies.

Juan Carlos de los Reyes

Affiliation - Centro de Modelización Matemática (MODEMAT), Escuela Politécnica Nacional

Title: Parameter estimation for the SARS-CoV-2 models under uncertainty in the data: the Ecuadorian case

Abstract: Upon the arrival of the Covid 19 to Ecuador, the Research Center for Mathematical Modeling of the Escuela Politécnica Nacional formed a specialized work team to model and simulate the spread of SARS-CoV-2, under various public policy scenarios applied to its containment. In this talk we explain the used models and the resulting simulations, and comment of the advantages and drawbacks of those. We will also present a Bayesian variational scheme used to estimate the different parameters of the models, in the presence of data uncertainty, and draw some conclusions.