Applied Mathematics and Covid-19

Submitted by Tony I Garcia on April 17, 2020 - 2:00pm

As the health crisis caused by the COVID-19 pandemic keeps the world in its grasp, all members of the Department of Applied Mathematics are working from home, taking and teaching courses remotely, while continuing their groundbreaking research. A number of research results produced by members of the department are having an immediate impact on how the government and others are responding to the crisis, while others may have a long-term effect on how future pandemics are approached.

At the request of hospitals and government officials, an interdisciplinary IHME team, under the leadership of Chris Murray has developed a COVID-19 model that forecasts deaths and peak resource use, with daily updates tracking US states and European countries. The model is based on a range of different data sources (see healthdata.org/covid for more information). Its main findings show that the impact of the COVID-19 pandemic on the United States will be severe even with strict adherence to social distancing measures.

The Math Sciences team headed by Applied Mathematics Associate Professor Sasha Aravkin, working closely with Chris Murray and other members of the IHME team, has supported these efforts by developing an open source inference tool called CurveFit to fit available data at locations around the world. The team includes Dr. Peng Zheng (a recent Amath graduate who is now an Acting Assistant Professor at IHME), IHME researchers and UW PhD students Marlena Bannick, Reed Sorensen, Jize Zhang, Aleksey Sholokhov, and Dr. Bradley Bell. The CurveFit program fits nonlinear curves to available death rate data updated daily, connecting trajectories of epidemics between locations by using social distancing covariates to model functional parameters at different locations. Updates and papers related to this project are available at http://www.healthdata.org/covid.
Another effort is due to KK Tung, the Frederic and Julia Wan Endowed Professor of Applied Mathematics at UW, and his collaborators Norden Huang and Fangli Qiao (both at the First Institute of Oceanography's Data Analysis Laboratory, Qiandao China). Their approach uses a new data-driven mathematical model of the corona virus pandemic, predicting that the US will experience its peak in the number of active COVID-19 cases on or around April 20. The model is intended to help officials see at least two weeks in advance how COVID-19 will strain the medical infrastructure in the US and elsewhere. It uses the number of newly diagnosed, recovered, and died individuals in a geographic region. More information can be found in the full UW News release.

In related work, Applied Mathematics Assistant Professor Eli Shlizerman and PhD student Erin Stafford are applying recurrent neural networks to predict the spread of influenza-like illnesses. They are developing the analyses for US national influenza statistics data (CDC), after which these same techniques will be applied to COVID-19 worldwide statistics.