

Los Angeles County has issued stay-at-home orders starting from March 19, 2020. Almost two months into the lockdown, warning emails from the UCLA Police Department brought our attention to the impact of lockdown on crimes within LA County. After following news on the recent downward trend of overall crime, we hypothesized that total crime cases would go up when the order is loosened. In this project, we explored crime change over the past ten years and projected the potential growth of LA County crime in the following year. We believe that researching crime trends can shed light on COVID-19's effects from an integrated perspective. Furthermore, this project could help the public, the government and police officers to be more prepared as we enter the next stage of the pandemic.

We collected 2010-2020 crime statistics from the Los Angeles County Sheriff's Department (LASD)<sup>1</sup>. We consulted past research related to crime change and included factors such as law enforcement and unemployment rate<sup>2</sup> in our analysis. As the spread of the virus may directly affect crimes in LA County, dataset on confirmed cases of COVID-19 was collected to analyze the trend<sup>3</sup>.

We first focus on using total crime cases per day since lockdown to project future criminality in the short-term future. We use the ARIMA model for forecasting because the p-value of unit-root test is greater than 0.05. We picked AR(1) model after plotting ACF/PACF to minimize AICc. The residuals of the selected model pass the Ljung-Box test and appear to be normal with mean 0 and constant variance. We use crime cases from 2010 to 2019 to predict long-term criminality in LA County. After plotting the time series, we find the graph exhibited seasonality so that it might not be stationary. We observed a 1-year seasonal cycle and a possible 5-year cycle. However, since we only care about 1-year prediction, we decide to only consider the 1-year seasonality. A harmonic regression approach where the seasonal pattern is modelled using Fourier terms with short-term time series dynamics handled by an ARMA error is more appropriate in our case. Using a line search to minimize AICs values, we find that an ARIMA(1,1,2) process with 12 pairs of Fourier sin and cos is the best fit. The residuals of this model pass the Ljung-Box with p-value greater than 0.05 and the residuals ACF plot show that they are random noises. As the time series since lockdown appears to be a stationary process with constant mean and the observations are comparatively limited with respect to the projection window we are interested, the predicted values soon converge to the mean of the observations. Hence, we decided to use the drift method to allow the short-term forecasts to increase over time and eventually reach historical mean and then evolve with the long-term forecasts.

As forecasted by our model, total crime in LA County would experience a gradual increase after reopening. Total cases would surpass the historical average in Aug 2020 and stabilize around 576 cases/day by the end of the year. Unemployment rate in the County has soared in March and is likely to continue the upward trend, which indicates the future growth of total crime due to their positive correlation. Moreover, since law enforcement is pivotal in controlling crime, the high rates of infection among police officers suggest the potential lack of policing practices in the future.

From the maps showing total incidents in the same month of 2019 and 2020, there is an obvious decrease in crimes of LA County. But some cities like Los Angeles and Compton still face higher risks than others. Looking closely at changes in specific crimes, we noticed that child abuse, sex, drink drug, and traffic experienced a drop in cases. However, these crime categories would probably increase as children returning to school and people's lives back to normal.

Our results indicate the need for further economic assistance, including another round of stimulus check from the Federal Government and unemployment benefits which accommodate the need for more people. The issue that law enforcement agencies might be understaffed in the following months should be addressed by providing sufficient protective equipment to the police officers and allocating available funding to encourage recruitment in police departments. More broadly, the general public should continue to take precautionary measures in order to support people who cannot work from home. We believe that the joint efforts from the public, the government and the police will smooth the transition to the future stages of the pandemic.

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<sup>1</sup> <http://shq.lasdnews.net/CrimeStats/CAASS/desc.html>

<sup>2</sup> <https://www.bls.gov/web/metro/laucntycur14.txt>

<sup>3</sup> [http://dashboard.publichealth.lacounty.gov/covid19\\_surveillance\\_dashboard/](http://dashboard.publichealth.lacounty.gov/covid19_surveillance_dashboard/)