**Time Series Analysis of Carbon Monoxide Levels in New York City**

Non-Technical Summary

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Since the dawn of the industrial revolution, global temperatures have an unprecedented rise due to human-driven rise in greenhouse gases.1 Carbon monoxide (CO), while not a major greenhouse gas itself, contributes indirectly due to its role in the production of tropospheric surface-level ozone (O3), which has adverse greenhouse effects (without the protective effects of stratospheric high-altitude ozone).2 Furthermore, both carbon monoxide and ozone are primary components of smog, which has a negative health effects on a city’s population, plants, and animals.3 Tracking the levels of CO in the air of a city is useful because it provides insight into the progress and future of curbing greenhouse gas emissions, but also a predictive model can be used by citizens to determine whether to spend time outside, wear masks, etc. - a practice that is becoming increasingly common in large metro areas globally.4

New York City, once infamous for its incredible smog, has introduced many regulations to improve air quality and reduce greenhouse gas emissions.5 Therefore, in this study we are analyzing, modeling, and forecasting a time series of CO levels in New York City. In order to obtain the best model, we tested numerous types of time series analyses, including: Autoregressive-Moving Average (ARMA) Analysis, Autoregressive Integrated Moving Average (ARIMA) Analysis, Generalized Autoregressive Conditional Heteroskedasticity (GARCH) Analysis, and Neural Network Analysis. Furthermore, we also analyze the cross-correlation relationship between Nitrogen Oxide (NO) on the main time series CO.

In more layman’s terms, we explored the sixteen years of data to see if one can predict next week’s CO level in NYC, by analyzing growth, drops, spikes, or changes of CO levels in the weeks before. We found a suitable model for forecasting carbon monoxide in city of New York, which, when backtested (using previous data), only had an error rate of 5.03%.

1. Climate Change: Vital Signs of the Planet. (2019). *Climate change evidence: How do we know?*. [online] Available at: https://climate.nasa.gov/evidence/ [Accessed 17 Mar. 2019].
2. Climate & Clean Air Coalition. (2019). *Tropospheric ozone*. [online] Available at: http://www.ccacoalition.org/ru/slcps/tropospheric-ozone [Accessed 17 Mar. 2019].
3. Canada.ca. (2018). *Smog and your health - Canada.ca*. [online] Available at: https://www.canada.ca/en/health-canada/services/air-quality/smog-your-health.html [Accessed 17 Mar. 2019].
4. Smedley, T. (2019). *Deadly air in our cities: the invisible killer*. [online] The Guardian. Available at: https://www.theguardian.com/environment/2019/mar/17/air-pollution-london-low-emission-zone-deadly-toxic-fumes [Accessed 17 Mar. 2019].
5. NYC Health. (2019). *Outdoor Air Quality*. [online] Available at: https://www1.nyc.gov/site/doh/health/health-topics/air-quality-air-pollution-protection.page [Accessed 17 Mar. 2019].