# Introduction

Outbreak in late December 2019, originating in a seafood market in Wuhan, Central China, the Corona virus was initially confirmed as a type of “strange pneumonia” or “unknown reason pneumonia”. After only 100 days of appearance, the acute respiratory infection caused by the Corona virus quickly affected the economic and social fields, the financial market wobbled, the global economy fell into a recession with a high inflation rate. Unemployment and poverty are unprecedented in history. Up to the time of this thesis, there have been 530M infected cases, and 6.3M deaths cases reported. The name “Corona” virus is derived from Latin, where “corona” means “crown” due to the shape of it. This virus has spikes on the outside, which interact with receptors on cells, in a similar way to keys and locks, thereby allowing the virus to get inside. The COVID-19 virus is spread mainly from person to person through respiratory droplets. Respiratory droplets are released into the air when people cough, sneeze, talk, shout or sing. These drops may land in the mouths or noses of people nearby, or they may inhale the droplets. Therefore facemask is a simple barrier that helps prevent droplets from your respiratory tract from reaching others. Studies show that masks that cover the nose and mouth help reduce the spread of droplets. So to prevent virus from spreading among the community, it's important to monitor facemask wearing in public spaces.

# Business Understanding

Since the unprecedented COVID 19 global pandemic happened, governments worldwide stay under lock-downs to prevent virus transmission, and wearing a facemask when communicating in public space is one of the most effective ways to avoid becoming infected with the virus. Hence, there is a need to monitor people wearing masks and doing this task manually is overwhelming and not applicable due to the large number of people in public space.

So, the intent of this project is to develop a computer vision system to automatically detect facemask in real time by leveraging Deep Learning techniques.

# Analytics Approach

On this project:

- Input is a image / frame from video

- Results are faces extracted from image / frame with corresponding labels. (mask, no\_mask, improperly)

Analytic approach:

- Deep Learning, and specifically, CNN is used here because of its efficiency with computer vision tasks.

- Face detector is for extracting faces from image / frame. Pretrained face detectors are well known and open, so we should pick one to use.

- Then the face classification model is used to classify faces into labels. (mask, no\_mask, improperly). We need to collect data to train this model.

# Data Requirement

Since we decided to build a face classification model, all we need is a dataset of faces with 3 labels: mask, no\_mask, and masked improperly. The faces should be in various sizes, directions, and lighting conditions.

We also want to leverage pretrained models, but data size should be around ~500 images per label, so we can avoid overfitting.

# Data Collection

Dataset in this thesis is a combination of 3 datasets above, a subset is randomly chosen from MaskedFace-Net and KinFaceW, and all images from FMDD dataset, final dataset contains 7458 images, 2862 mask images, 1752 no mask images, 2844 improperly images.

Too small /large face images are filtered.

Faces with hard-to-find masks are filtered.





