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Face Mask Detection using Machine Learning

Varsha Shantaram Salve, Vaishnavi Mangesh Chavan, Pallavi Madhukar Gawade, Dipika Ravsaheb Kapare, Prof. Panzade. B. V.

HSBPVT's GOI College of Engineering, Kashti, Ahmednagar, Maharashtra, India

Abstract: *In this project, we present a susceptible–infected– recovered (SIR) model with individuals wearing facial masks and individuals who do not. The disease transmission rates, the recovering rates, and the fraction of individuals who wear masks are all time-dependent in the model.We develop a progressive estimation of the disease transmission rates and the recovering rates based on the coronavirus disease 2019 (COVID-19) dating a published by John Hopkins University. We determine the fraction of individual who wear masks by a maximum likelihood estimation, which maximizes the transition probability of a stochastic SIR model. The transition probability is numerically difficult to compute whether the number of infected individuals is large. We develop an approximation for the transition probability based on the central limit theorem and mean-field approximation. We show through numerical study that our approximation works well. We develop a bond percolation analysis to predict the eventual fraction of population who are infected, assuming that parameters of the SIR model do not change anymore. The percolation threshold is exactly the basic reproduction number of the epidemic. We predict the outcome of COVID-19 pandemic using our theory.*

Keywords: Bond percolation, coronavirus disease 2019 (COVID-19), epidemic network, masks, susceptible–infected–recovered (SIR) model.

I. Introduction

1.1 Overview

At the beginning of 2020, the 2019 coronavirus outbreak (COVID-19) has become a worldwide pandemic. The epidemic was seen by the World Health Organisation (WHO) and end January 2020 as a Public Health International Concern Emergency (PHEIC). About 1,5 million cases of COVID19 have been registered worldwide up until 10 April 2020, with over 92 thousand deaths. Covida-19 patients are typically suffering from pneumonia due to fever, cough and shortness of breath. The whole world today, is facing the COVID-19 pandemic. People are using various measures to control spread of Corona virus. One of them is a face mask detection system to identify people with face masks. Wearing face masks and social distancing are two of the enhanced safety protocols needs to be followed in public places in order to prevent the spread of the virus. The project "Face Mask Detection using Machine Learning" is a system that contributes to public healthcare, as it helps in keeping environment healthy. Face detection is defined as the procedure that has many applications like face tracking, pose estimation or compression. Face detection is a two-class problem where we have to decide if there is a face or not in a picture. This approach can be seen as a simplified face recognition problem.

In this project, we present a susceptible–infected– recovered (SIR) model with individuals wearing facial masks and individuals who do not. The disease transmission rates, the recovering rates, and the fraction of individuals who wear masks are all time-dependent in the model.We develop a progressive estimation of the disease transmission rates and the recovering rates based on the coronavirus disease 2019 (COVID-19) dating a published by John Hopkins University. We determine the fraction of individual who wear masks by a maximum likelihood estimation, which maximizes the transition probability of a stochastic SIR model. The transition probability is numerically difficult to compute whether the number of infected individuals is large. We develop an approximation for the transition probability based on the central limit theorem and mean-field approximation. We show through numerical study that our approximation works well. We develop a bond percolation analysis to predict the eventual fraction of population who are infected, assuming that parameters of the SIR model do not change anymore. The percolation threshold is exactly the basic reproduction number of the epidemic. We predict the outcome of COVID-19 pandemic using our theory.

1.2 Motivation

- Whole world is facing covid-19 pandemic. For that we have decided to do that is useful for current situation.

- Corona virus spreads through respiratory system that is network of organs and tissues that help you to Breathe. For preventing the corona virus face mask is most necessary thing.
- For that we decided to do the project on “Face Mask Detection” for detecting the person who has Weared a mask or not. That’s the motivation behind the project.

III. RELATED WORK

Recently, COVID-19 has attracted a lot of attention of researchers from different fields. Wearing masks is a frequently adopted precautionary measure. In this paper, we investigate the effect of behavior of wearing masks on epidemic dynamics in the context of COVID-19. At each time, every susceptible individual chooses whether to wear a mask or not in the next time step, which depends on an evaluation of the potential costs and perceived risk of infection. When the cost of infection is high, the majority of the population choose to wear masks, where global awareness plays a significant role. However, if the mask source is limited, global awareness may give rise to a negative result. In this case, more mask source should be allocated to the individuals with high risk of infection[1].

To confront the global Covid-19 pandemic and reduce the spread of the virus, we need to better understand if face mask use is effective to contain the outbreak and investigate the potential drivers in favor of mask adoption. It is highly questionable since there is no consensus among the general public despite official recommendations. For the first time, we conduct a panel econometric exercise to assess the dynamic impact of face mask use on both infected cases and fatalities at a global scale. We reveal a negative impact of mask wearing on fatality rates and on the Covid-19 number of infected cases. The delay of action varies from around 7 days to 28 days concerning infected cases but is more longer concerning fatalities. We also document the increasing adoption of mask use over time. We find that population density and pollution levels are significant determinants of heterogeneity regarding mask adoption across countries, while altruism, trust in government and demographics are not. Surprisingly, government effectiveness and income level (GDP) have an unexpected influence. However, strict government policies against Covid-19 have the most significant effect on mask use. Therefore, the most effective way of increasing the level of mask wearing is to enforce strict laws on the wearing of masks [2].

Mandatory and voluntary mask policies may have yet unknown social and behavioral consequences related to the effectiveness of the measure, stigmatization, and perceived fairness. Serial crosssectional data (April 14 to May 26, 2020) from nearly 7,000 German participants demonstrate that implementing a mandatory policy increased actual compliance despite moderate acceptance; mask wearing correlated positively with other protective behaviors. A preregistered experiment (n = 925) further indicates that a voluntary policy would likely lead to insufficient compliance, would be perceived as less fair, and could intensify stigmatization. A mandatory policy appears to be an effective, fair, and socially responsible solution to curb transmissions of airborne viruses [3].

In this paper, Author propose a novel epidemic model by using two-layer multiplex networks to investigate the multiple influence between awareness diffusion and epidemic propagation, where the upper layer represents the awareness diffusion regarding epidemics and the lower layer expresses the epidemic propagation. In the process of awareness diffusion, the unaware individuals will be aware of the epidemics if the ratio between their awareness neighbors and their degrees reaches the specified ratio. For the epidemic spreading in the lower layer, we use the classical SIR(susceptible-infected-recovered) model. We derive the epidemic threshold by using Micro-Markov chain approach. The analytical results indicate that the epidemic threshold is correlated with the awareness diffusion as well as the topology of epidemic networks. Finally, the simulation results further demonstrate the properties of epidemic propagation and validate the analytical results [4].

The current pandemic coronavirus, SARS-CoV-2, was recently identified in patients with an acute respiratory syndrome, COVID-19. To compare its pathogenesis with that of previously emerging coronaviruses, we inoculated cynomolgus macaques with SARS-CoV-2 or MERS-CoV and compared the pathology and virology with historical reports of SARS-CoV infections. In SARS-CoV-2-infected macaques, virus was excreted from nose and throat in the absence of clinical signs, and detected in type I and II pneumocytes in foci of diffuse alveolar damage and in ciliated epithelial cells of nasal, bronchial, and bronchiolar mucosae. In SARS-CoV-infection, lung lesions were typically more severe, while they were milder in MERS-CoV infection, where virus was detected mainly in type II pneumocytes. These data show that SARS-CoV-2 causes COVID-19-like disease in macaques, and provides a new model to test preventive and therapeutic strategies [5].

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III. PROPOSED SYSTEM

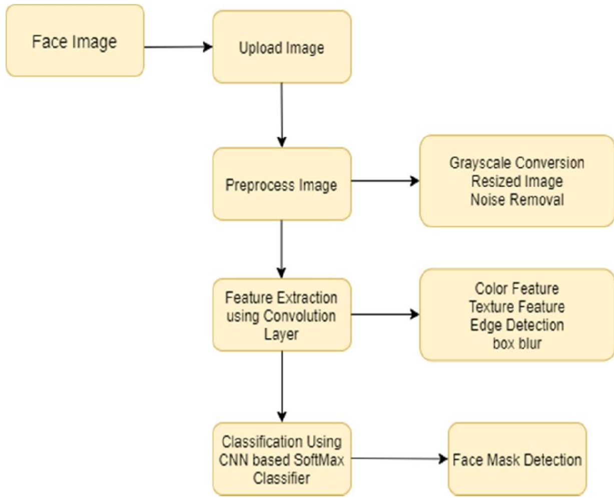


Figure 1: System Architecture

3.1 Algorithm

Convolution Layer

Convolution is the first layer to extract features from an input image (image). Convolution preserves the relationship between pixels by learning image features using small squares of input data. Convolution of an image with different filters can perform operations such as edge detection, blur and sharpen by applying filters i.e. identity filter, edge detection, sharpen, box blur and Gaussian blur filter.

Pooling Layer

Pooling layers would reduce the number of parameters when the images are too large. Spatial pooling also called subsampling or down sampling which reduces the dimensionality of each map but retains important information.

Fully Connected Layer

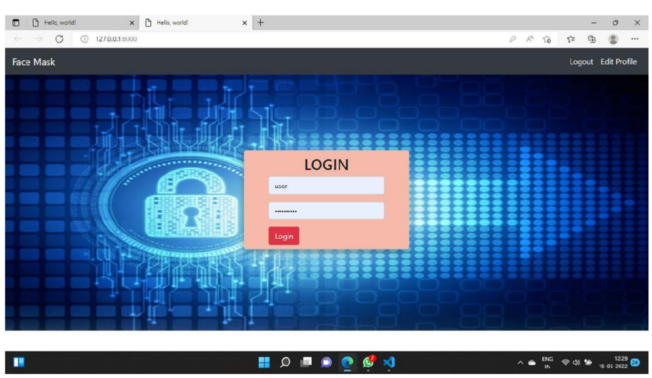
In this layer Feature map matrix will be converted as vector (x1, x2, x3, …). With the fully connected layers, we combined these features together to create a model.

Softmax Classifier

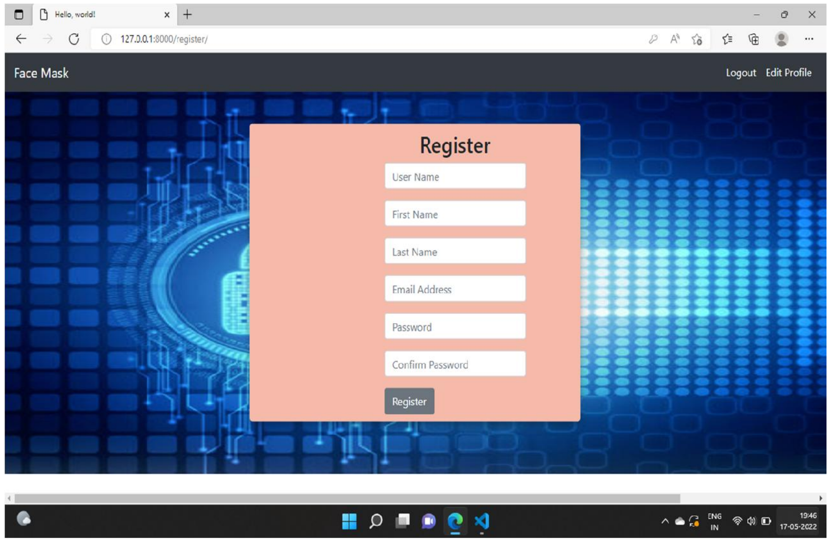
Finally, we have an activation function such as softmax or sigmoid to classify the outputs.

IV. RESULTS AND DISCUSSIONS

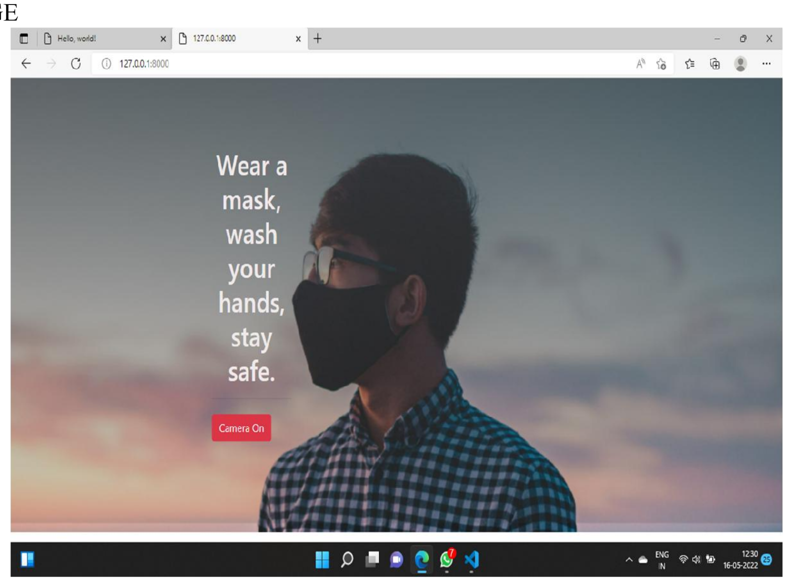
LOGIN PAGE



REGISTER PAGE



FACE DETECT PAGE



V. Conclusion

- As technology advances and new trends emerge, we now have a revolutionary face mask detector that may be useful in public healthcare.
- To get more information, We use machine learning to adopt weights because of their robust properties.
- Face detection is a similar task that is trained on a very large dataset.

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