Face Mask Detection Using Keras and Flask

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ABSTRACT: The COVID-19 pandemic has quickly disrupted global trade and travel, affecting our day to day lives. It has been standard practice to use a face mask for protection. Many public service providers will require proper face mask wear soon for customers to use their services. Facemask Detection is now an essential responsibility to assist the worldwide civilization. This paper outlines a condensed method for achieving this goal can certain fundamental machine learning tools, including TensorFlow, Keras, OpenCV, and Scikit-Learn. The suggested method correctly extracts the face from the image before determining whether it has a mask on it. It can detect a face and a mask in motion as a surveillance task performance.

On two separate datasets, be found to outperform any prior method or strategy utilized to determine sentence polarity. Thus, the approaches achieve accuracy of up to 95.77% and 94.58% respectively. We investigate enhanced values. The goal of this project is to make easier for the authorities to maintain the laws and regulation. This technique will identify the percentage mask that is being worn on a person's face. In this manner, it may be determined whether it has been worn effectively to stop infections. If the mask is not worn the user will be highlighted and, after identification, we can issue a warning if is being used in public areas.

1. INTRODUCTION

Over 20 million people worldwide have been infected with the coronavirus disease 2019 (COVID-19), which has resulted in over 0.7 million fatalities, according to the World Health Organization's (WHO) official Situation Report - 205 [1]. People with COVID-19 have reported experiencing a wide range of symptoms, from mild indications to major sickness. One of them is a respiratory issue like shortness of breath or breathing difficulties. As they seem to be at higher risk, elderly individuals with lung disease may experience serious complications from the COVID-19 illness [2]. The human coronaviruses 229E, HKU1, OC43, and NL63 are some of the frequent ones that infect people worldwide. Viruses like 2019-nCoV, SARS-CoV, and MERS-CoV initially infect animals before becoming human coronaviruses and causing illness in humans [3]. Anyone who comes into contact with someone who has respiratory issues could become infected by the infectious beads. This system uses real-time video streaming and image input to determine if a person is wearing a mask or not. If a person is wearing a mask, a green frame will be displayed around their face along with the signal "Mask with percentage," and if they are not, a red frame will be displayed and the signal "No Mask with percentage" will be displayed. Deep learning and computer vision form the foundation of the Face Mask Detection model. The model uses OpenCV, Tensor Flow, and Keras to integrate deep learning with traditional machine learning methods.

RELATED WORKS

In the face detection approach, a face is found in an image that has a number of qualities. [21] asserts that face detection research needs position estimation, face tracking, and expression recognition. The difficulty lies in recognizing the face from a single image. Face identification is a challenging task since faces are not unchanging and alter in size, shape, color, and other aspects. For an opaque image impeded by something else not facing the camera, etc., it becomes a difficult task. According to authors in [22], occlusive face detection has two significant obstacles: 1) There are no substantial datasets with both masked and unmasked faces available, and 2) facial expression is not included in the covered region. utilizing the dictionaries trained on a colossal pool of masked faces and the locally linear embedding (LLE) algorithm. Synthesized everyday faces allow for the recovery of several lost expressions and a significant reduction in the prominence of facial cues. Convolutional neural networks (CNNs) in computer vision come with a stringent constraint regarding the size of the input image, according to the work presented in [11]. To get over the inhibition, the common practice is to reorganize the images before fitting them into the network. Here, correctly identifying the face from the image and determining whether it is covered by a mask is the task's main problem. The proposed approach should be able to recognize a face combined with a mask in motion to carry out surveillance duties. Numerous research papers have been written about object detection and face recognition thus far. For instance, it is described how to implement face mask detection with the aid of deep learning and open-source machine learning libraries like Keras and TensorFlow in A. Rosebrook, 2020. COVID-19: Face Mask Detector with OpenCV, Keras/TensorFlow, and Deep Learning - Pyimagesearch.

The edge or line detection features that Viola and Jones proposed in their 2001 study "Rapid Object Detection using a Boosted Cascade of Simple Features" are used by the object detection algorithm. To train, the algorithm is given many positive photos with faces and a large number of negative images without any faces. The human faces in a frame or image are located using an algorithm in the Viola — Jones research. Some characteristics of human faces are universal, such as the nose being brighter than the eye region and the eyes being darker than its neighboring pixels.
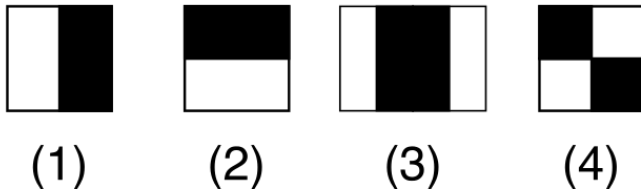
METHODOLOGY

1. DEEP LEARNING

From the provided examples, the deep learning architecture picks up a variety of important nonlinear features. Then, samples that have never been seen before are predicted using the learned architecture. We collected photos from various sources to train our deep learning architecture. CNN has a significant impact on how the learning process is structured. The sections that follow examine each component of deep learning architecture. How to Get Datasets: Data is gathered to train and test the model from two independent sources. 1915 images of people wearing and not wearing masks in public were collected. 80 percent of the images are used for training, while the remaining 20% are used for testing.

2. TENSORFLOW

A free and open-source dataflow and differentiable programming software framework called TensorFlow can be used to solve a variety of issues. It is a symbolic math library that is also utilized in neural network applications for machine learning. TensorFlow, Google's second-generation technology, is used in both research and production.

3. KERAS

Instead of being machine-centric, Keras is a human-centric API. Keras follows best practices for reducing cognitive load by offering consistent and simple APIs, reducing the amount of user interactions required for typical use cases, and delivering clear and actionable error signals. To make working with neural networks simpler, Keras includes numerous implementations of standard building blocks for neural networks, including layers, objectives, activation functions, optimizers, and a plethora of other tools.

4. PyTorch

Based on the Torch library, PyTorch is an open-source machine learning framework for computer vision and natural language processing. The FAIR team at Facebook generated the most of it.

5. Applications

Airports: The suggested method could be quite helpful in identifying those who aren't wearing masks when passing through airports. Traveler information may be gathered at the entry as films in the system. If a passenger is seen leaving the airport without a face mask, the airport authorities are alerted so they can act quickly.

Hospitals: The suggested method can be used in conjunction with CCTV cameras to check whether or not staff are wearing masks. A warning may be given to a medical professional to put on a mask.

Office: The technique suggested could help maintain safety standards and stop the spread of Covid-19 or any other airborne infection. A message of reminder may be given to a worker who is not donning a mask. When choosing a system, the best performance must be taken into account. As a result, when designing the ideal system for a large-scale implementation, the aforementioned performance indicators can be taken into account.

THE PROPOSED METHOD

A cascade classifier and a pre-trained CNN with two 2D convolution layers coupled to layers of dense neurons make up the suggested technique. The algorithm used to detect face masks is as follows:

DATA SETS

The current strategy has been tested using two datasets. Dataset 1 contains 1376 photos, 690 of which include people wearing face masks and the remaining 686 feature people without face masks. It primarily consists of front-facing poses with a single face in the frame and the same kind of mask in just white.

There are 853 photos in Kaggle's Dataset 2 that have their faces clarified either with or without masks. Figure 2 shows a few face collections with heads turned, tilted, and slanted heads, several faces in the frame, and various forms of masks in various colors

Processing data: Processing data Pre-processing entails converting data from one format to another that is more aesthetically pleasing, functional, and meaningful. It may take any format, including tables, pictures, movies, graphs, etc. This organized information captured the relationships between various things and fit into an information model or composition. NumPy and OpenCV are used in the suggested way to work with image and video data.

DATA VISUALIZATION

The process of turning abstract data into meaningful representations using encodings, knowledge exchange, and insight finding is known as data visualization. Studying a specific trend in the dataset is beneficial. Both the "with mask" and the "without mask" categories are used to visualize the total number of photos in the collection. The statement groups the list of directories in the supplied data path into categories (data path). The variable categories now appear as follows: ['with mask,' 'without mask'] We must then use labels to separate these groups in order to get the number of labels. The labels are set to [0, 1]

TRAINING OF MODEL

Building The Model Using CNN Architecture

CNN has risen to the top in a variety of computer vision challenges. Sequential CNN is used in the current approach. The Rectified Linear Unit (ReLU) and Max-Pooling levels come after the First Convolution layer. Convolution layer picks up information from 200 filters. The 2D convolution window's height and width are specified by the 3 x 3 setting of the kernel size. The initial layer of the model needs to be given information regarding input shape since the model should be aware of the predicted shape of the input. The following layers are capable of automatic shape reckoning. In this instance, input shape is defined as data, and shape [1:] provides the data array's dimensions starting at index 1. Where the spatial dimensions are approved to, default padding is "valid".

Picture

A Dropout layer is added to the model with a 50% chance of setting inputs to zero in order to lessen overfitting. Then, a dense layer of 64 neurons is added, each of which has a ReLu activation function. The SoftMax activation function is used in the final layer, called Dense, which has two outputs for two categories**.**

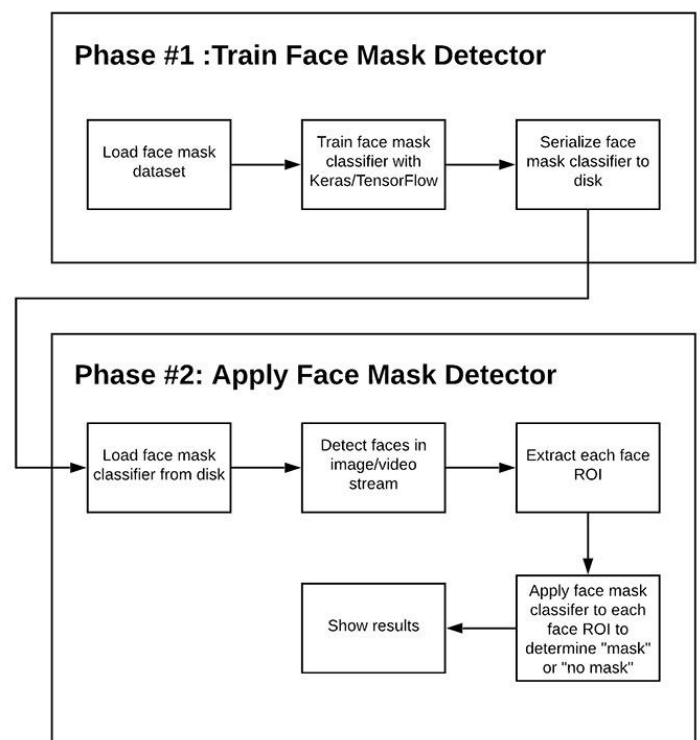### 1.Spliting the Data and Training the CNN Model

The model must be trained using a certain dataset and then tested against a different dataset after creating the blueprint for data analysis.

20 epochs (iterations).

ARCHITECTURE

When making a prediction, an appropriate model and an optimized train-test split help to produce reliable results. The test size is set to 0.1, meaning that 90% of the dataset's data is used for training and the remaining 10% is used for testing. Model Checkpoint is used for monitoring the validation loss. The Sequential model is then fitted to the images in the training set and test set. The validation data in this case represents 20% of the training data. A trade-off between accuracy and overfitting risks is maintained by training the model for
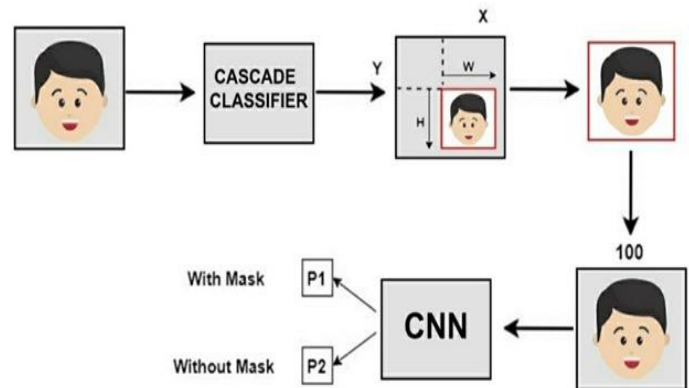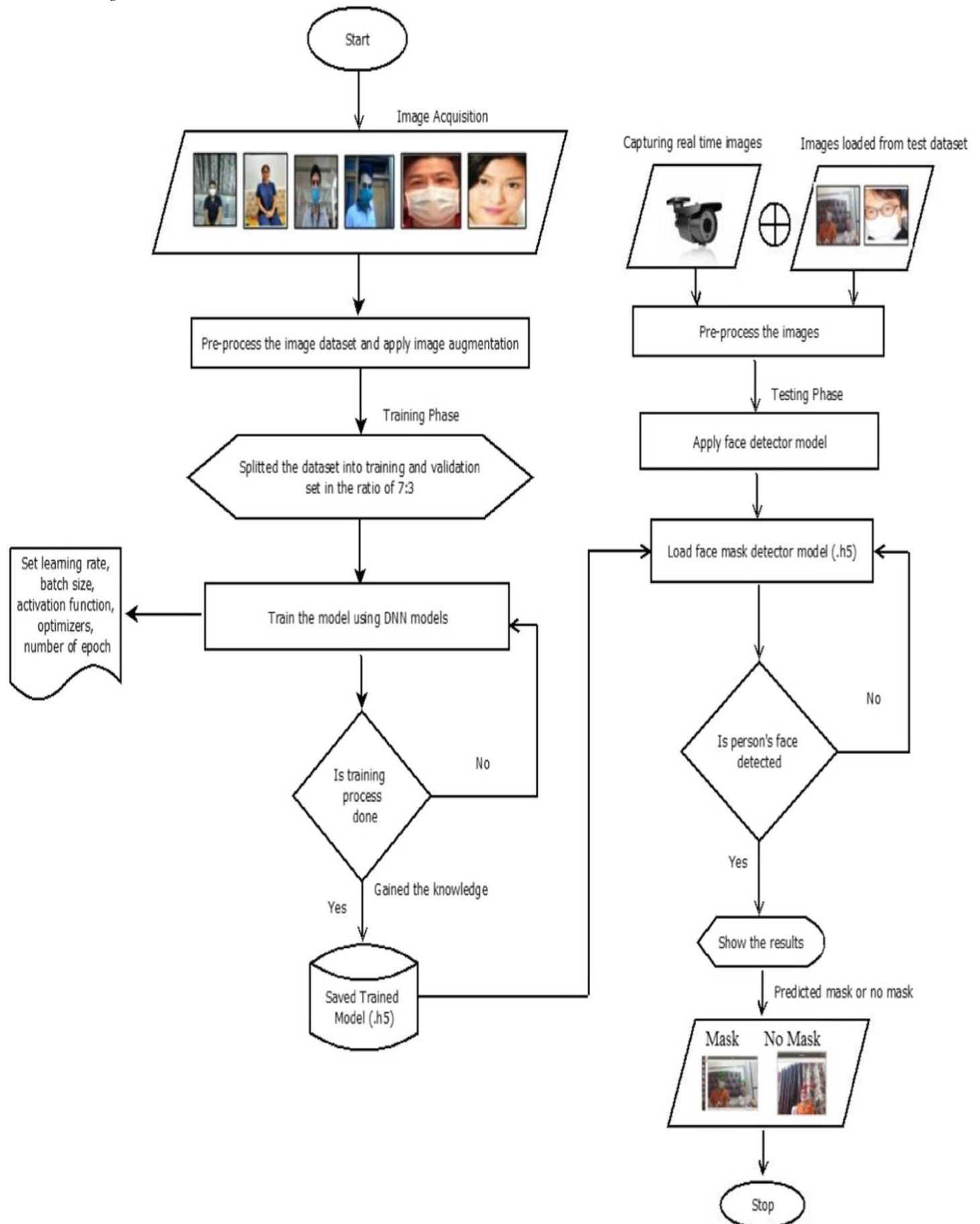
Data Flow Diagram

PROJECT DISCRIPTION

Problem Definition

The COVID-19 pandemic has abruptly altered our daily routines. Gatherings are prohibited, and even when leaving the house is necessary for health or professional reasons, a face mask must be worn to minimize the risk of infection. It is essential in this situation to identify infractions committed by those who are not wearing face masks. ace Mask detection has proven to be a startlingly challenging issue in the field of image processing and computer vision. Face detection has many applications, including face identification and the capture of facial gestures, the latter of which necessitates the face being exposed with extreme accuracy.

Project Overview

There is authentication available to access the application. There is a username and password for the user. admin and student are the two different categories of users. It enters a different type of module after logging in, depending on the choice made at the time of login. It logs on to the admin module if the user is an administrator; else, it logs on to the student module. The admin may oversee the student module. If the balance is paid, the administrator can view the fee status and collect the no-due form from a specific student. Additionally, a student may access the fee status and obtain his or her no-due form.

EXISTING SYSTEM

The COVID-19 pandemic is the most dramatic occurrence to shock the planet since the year started, among a mind-boggling succession of events that the year 2020 has presented humanity. COVID-19, which has a negative impact on the health and life of many people, has demanded that stringent precautions be taken to stop the spread of disease.
When people leave their homes, they cover their faces, and authorities strictly enforce this rule when people are in crowds and public spaces.

PROPOSED SYSTEM

The suggested system has evolved to address the flaws of the current one.
The goal of this initiative is to ensure that everyone is adhering to the fundamental safety rules. This is accomplished by creating a face mask detection system.

• Django, web2py, and Flask support (only available in the professional edition)

• Google App Engine Python development; • Integrated version control: unified user interface for Mercurial, Git, Subversion, Perforce, and CVS with change lists and merge; • Integrated unit testing, with line-by-line code coverage.

• Support for scipy, numpy, and other scientific tools (professional edition only)

NOTEPAD++

Notepad++ is a multilingual source code editor and Notepad replacement that is free (both in the sense of "free speech" and "free beer"). Its use is governed by the GNU General Public License and runs in the MS Windows environment. Notepad++ is written in C++

and employs pure Win32 API and STL, which guarantees a faster execution speed and reduced programmed size. It is based on the robust editing component Scintilla. Notepad++ aims to lower global carbon dioxide emissions by optimizing as many processes as it can without sacrificing user friendliness. The PC may throttle down and use less power while using less CPU power, making the environment greener.

DEVELOPMENT TOOLS & TECHNOLOGIES

Python

Python is an object-oriented, interpreter-based programming language. Modules, exceptions, dynamic typing, very high-level dynamic data types, and classes are all included. Python has a fantastic amount of capability and a relatively simple syntax. It may be extended in C or C++ and offers interfaces for many system calls, libraries, and window systems. Additionally, it can be used as an extension language for programs that require programmable user interfaces. Python is also portable; it works on the Mac, Windows 2000 and later, numerous Unix variations, and other platforms. Guido van Rossum was reading the published scripts from the 1970s BBC comedy series "Monty Python's Flying Circus" while he started using Python.

It has machine learning-backed methods for advanced face detection. The algorithms detect faces in an image by breaking it down into thousands of patterns and features that it matches. The tasks to match such features are called classifiers.

ALGORITHM

Input: Dataset including faces with and without masks
Output: Categorized image depicting the presence of face mask
1 **for** *each image in the dataset* **do**
2   Visualize the image in two categories and label them
3   Convert the RGB image to Gray-scale image
4   Resize the gray-scale image into 100 x 100
5   Normalize the image and convert it into 4 dimensional array
6 **end**
7 **for** *building the CNN model* **do**
8   Add a Convolution layer of 200 filters
9   Add the second Convolution layer of 100 filters
10   Insert a Flatten layer to the network classifier
11   Add a Dense layer of 64 neurons
12   Add the final Dense layer with 2 outputs for 2 categories
13 **end**
14 Split the data and train the model

CONCLUSION

In this publication, we initially provided a brief explanation of the work's motivation. The model's learning and performance task was then illustrated. The strategy has produced reasonably high accuracy using simple ML tools and simplified procedures. There are numerous applications for it. Given the Covid-19 crisis, wearing a mask might soon be required. To use the services of several public service providers, clients must properly wear masks. The public health care system will benefit greatly from the deployed model. In the future, it might even be able to tell if someone is wearing their mask correctly. The model can be further enhanced to determine whether the mask is susceptible to viruses, i.e.

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