

# Artistic Style based Image-Identification Captcha

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**Abstract** - With an increasing number of automated software bots and automated scripts that exploit public web services, with this web security has become a critical and challenging issue due to the growth of internet, a solution to this problem is Turing test here the user is supposed to solve CAPTCHA (Completely Automated Public Turing test) so that it becomes easy to identify robot and a human later they are allow to use the required service .The task given here are easy to be solved by a human. Image-based CAPTCHAs, which emerged as a substitute for test CAPTCHAs, they are more secured since image contain more information like color, texture, position. In this paper, a method to deceive the machine while maintaining the human perception rate by applying the neural style transfer method is proposed. This method creates a style-plugged-CAPTCHA image by combining the styles of different images while and using content image as base.

**Key Words:** CAPTCHA, Convolutional Neural Network (CNN), Stylized CAPTCHA, VGG.

## 1. INTRODUCTION

The Security is not only regarding to a system, data and network but also extends its operation to online services. Due to wide growth in the web services, online facilities are widely used. Internet services are beneficial as well as prone to attacks like misusing the availability web services by posting negative comments. Therefore, detection and control measure are to be adopted to ensure effective utilization of online services.

Recently, automated attacks are being made using machines with good computing performance. Because these automated attacks become available for unlimited subscriptions, spam messages and Dos attacks on web sites, security solutions are becoming more important to prevent automated attacks. CAPTCHA method consists of asking a question that the machine cannot understand but a human understands it. If the requester's response is determined correct, the service is provided if not service is rejected.

CAPTCHA is of four types, namely 1. Text Based, 2. Image Based, 3. Audio Based and 4. Video Based. This paper is focused on image-based CAPTCHAs. In Image Based CAPTCHAs, the main objective is either to identify an

image or an object in image, the user is supposed to name or distinguish or identify anomalies. In implicit CAPTCHAs, the user does not have to read or type anything and just makes simple clicks on hot spots neural style transfer is applied to enhance the security for CAPTCHA design.

Grid-CAPTCHA and Font-CAPTCHA, are two types of Image Based CAPTCHA methods based on which neural style transfer are proposed. In Grid-CAPTCHA nine stylized images are offered to users where user is asked to select all corresponding images as per the given description and In Font-CAPTCHA users is supposed to click Chinese characters present in the image in sequence according to the description.

Applications of CAPTCHAs are Comment Spam, Online Polling, Web Registration, Preventing Dictionary Attacks, Protecting Confidential Web Pages, Smart Cards and online games. Proposed method is useful for generating CAPTCHA images in large quantities and also used to generate images of different styles.

CAPTCHA is primarily used to distinguish between man and bot. CAPTCHA have many challenges for the AI community, and invites security researchers as well as malicious programmers, to work on advancing the field of Artificial Intelligence.

## 1.1 Methodology

The proposed method accepts the original image (content image) and style image as input, and generates a new image that combines the content of the original image and style of the other image, thus giving output of differently filtered versions of the input image.

Convolutional Neural Network (CNN) it is a collection of several convolutional layers and pooling layers. Convolutional Layer extracts highly complex features from a given image while pooling layer discards detailed spatial information that is not relevant for an image classification problem. Custom Loss Function is used to get a smooth stylistic image built from the content and the style images. It is combination of Content Loss which makes sure that the net amount of content is preserved and Style Loss which takes care of the amount of style getting transferred to the target image.

## 2. IMPLEMENTATION AND DESIGN

### 2.1 Style transfer

Steps used in proposed system to perform style transfer are:

1. **Content and Style image representation:** The Convolutional neural network is used for image classification and analysis. To extract the content of given image, feature maps are used where each unit on the feature map looks for the same feature but at different locations of the input image. To extract style i.e. only color and texture we use correlation which gives a measure of similarity of two or more variables.
2. **Image classification model:** The VGG-19 CNN architecture is used for extracting both content and style features from content and style images.
3. **Set up loss functions:** The content loss is defined as overall Euclidean distance between feature map and given content layer. The style loss is determined using Euclidean distance between Gram matrix and given style layer. Finally analyzing the total loss function.
4. **Optimize for variation loss function:** The decrease in the losses using an explicit regularization term on the high frequency components of the image is called total variation loss. We can observe these changes in the target image.

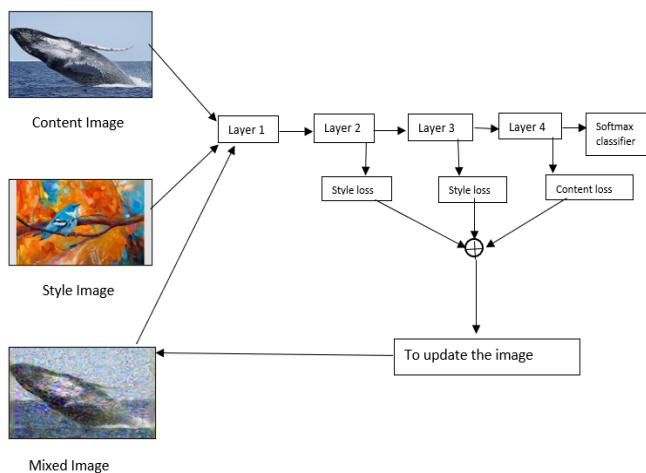


Fig 1.1 Design of the creating a styled image.

### 2.2 Stylized Captcha

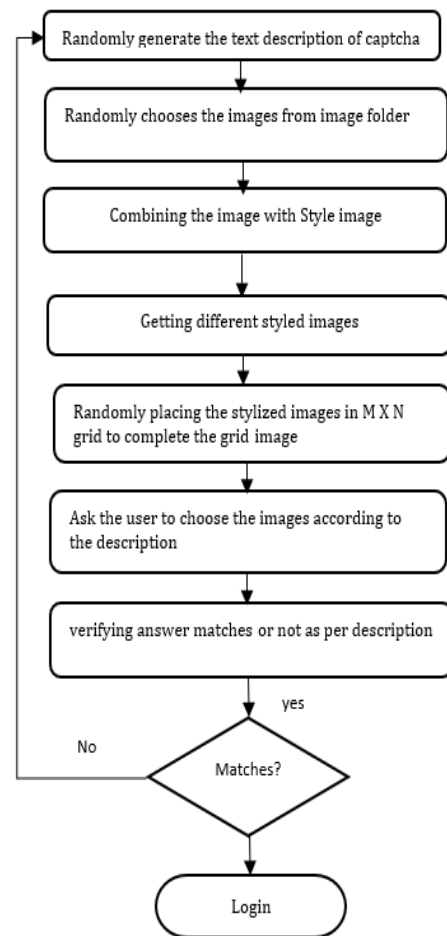


Fig 2.1 Flowchart of generating a grid Captcha.

From the above flowchart explains the process of the application of stylized captcha. Generating randomly the text description of captcha. The algorithm randomly chooses style transferred images to fit into the grid. By Getting 9 images and randomly placing the stylized images in M X N grid to complete the grid image. The user has to choose the images according to the description while logging in or signing up. The images clicked by the user are verified using Image matching algorithm.

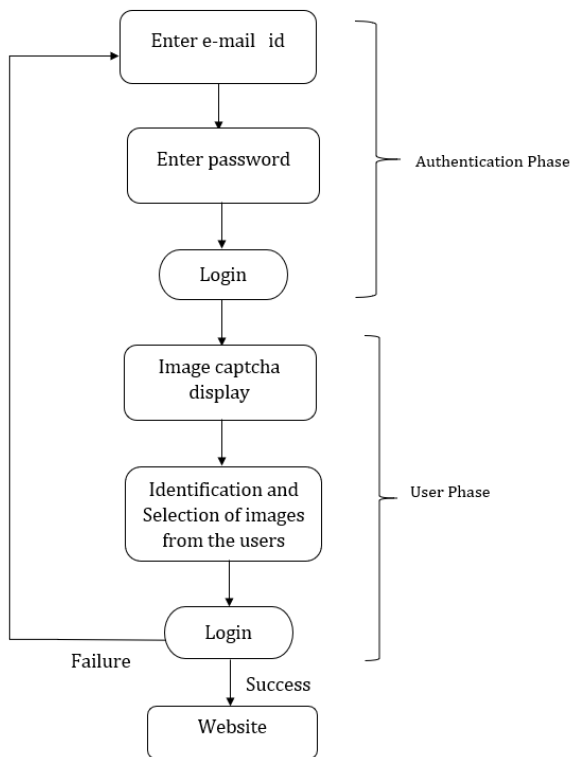


Fig 2.2 Process flowchart

The image database consists of images that can be easily recognizable. The process consists of two Phases namely authentication phase and user phase. In authentication phase, must provide valid email id and password. Once the login is successful the image captcha will be display which is the user phase. Here the user must identify and select images according to the description given. This gets verified, if matches the user can login into the website or else back to the process of authentication phase.

### 3. EXPERIMENT AND RESULTS

For evaluation of algorithm, environment used are Windows operation system. The device is also equipped with processor intel core i5 to accelerate the training process of the style transfer network and RAM 8GB, using Jupyter platform. The relevant software versions are Python 3.6.9, TensorFlow 2.0



Fig 3.1 Results of image style transfer

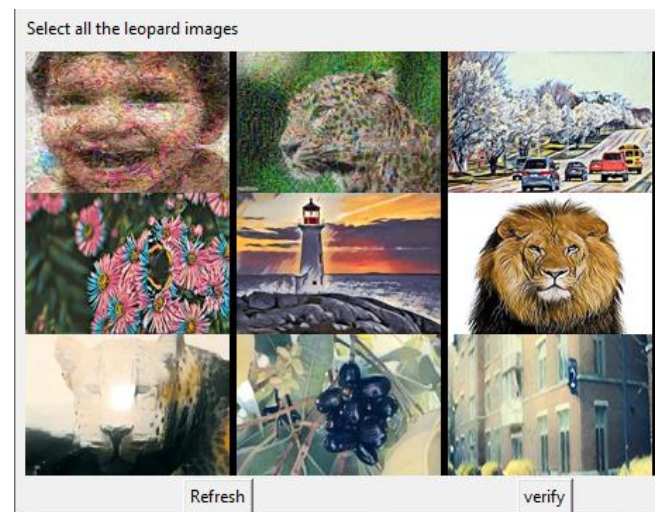


Fig 3.2 Results of stylized captcha

### 4. CONCLUSIONS

The results suggest that neural style transfer can clearly decrease the success rate of classification, localization, and recognition for machine attacks. In conclusion, when implementing neural style transfer on common CAPTCHAs the difficulty in breaking the CAPTCHA for machines rises, while the difficulty for human remains the same. We hope this research provides a new meaning to neural style transfer and will also inspire more extensive and exciting works in this research area to promote the development of CAPTCHA. This technique offers a new direction in designing CAPTCHAs and increases security.

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compared to existing similar schemes. We expect that there will be more researchers using deep learning techniques to increase CAPTCHA's security.

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