**Steganography**

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Steganography: is the practice of concealing a file, message, image, or video within another file, message, image, or video. The advantage of steganography over [cryptography](https://en.wikipedia.org/wiki/Cryptography) alone is that the intended secret message does not attract attention to itself as an object of scrutiny. Plainly visible encrypted messages, no matter how unbreakable they are, arouse interest and may in themselves be incriminating in countries in which [encryption](https://en.wikipedia.org/wiki/Encryption) is illegal.

In other words, steganography is more discreet than cryptography when we want to send a secret information. On the other hand, the hidden message is easier to extract.

## Task 1: Algorithm LSB

LSB-Steganography: LSB-Steg module is based on OpenCV to hide data in images. It uses the first bit of every pixel, and every color of an image. The code is quite simple to understand; If every first bit has been used, the module starts using the second bit, so the larger the data, the more the image is altered. The program can hide all of the data if there is enough space in the image. The main functions are:

* encode text: You provide a string and the program hides it
* encode image: You provide an OpenCV image and the method iterates for every pixel in order to hide them. A good practice is to have a carrier 8 times bigger than the image to hide (so that each pixel will be put only in the first bit).
* encode binary: You provide a binary file to hide; This method can obfuscate any kind of file.

Test1:

A large red brick building

Description automatically generatedA picture containing building, outdoor

Description automatically generatedA large red brick building

Description automatically generatedA close up of a door

Description automatically generated

Test 2:

A group of people on a boat

Description automatically generatedTwo people standing on a beach

Description automatically generatedA group of people on a boat in the water

Description automatically generatedTwo people standing next to a body of water

Description automatically generated

Test 3:

A statue of a person

Description automatically generatedA picture containing person, wearing, indoor, wall

Description automatically generatedA statue of a person

Description automatically generatedA close up of a person wearing a mask

Description automatically generated

Test 4:

A group of people on a boat

Description automatically generatedA statue of a person

Description automatically generatedA group of people on a boat

Description automatically generatedA statue of a person

Description automatically generated

Issue: the algorithm works fine when two pictures have the same size, however, when two pictures have different size, the hidden image will have a boundary cutting off the picture, which means the size of information of hidden image is limited by the size of the image to hide in (see test 2&3 above)

**Task 2: Neural Network**

Deep neural networks are simultaneously trained to create the hiding and revealing processes and are designed to specifically work as a pair. The system is trained on images drawn randomly from the ImageNet database, and works well on natural images from a wide variety of sources.

The loss-diagram is:

A screenshot of a cell phone

Description automatically generated

The following test is using the model trained by images from Kaggle (256 x 256). When using only half of the dataset to train the model, the result is much worse the following result. However, along with thee increase of the training data, the result is getting better. We also tried the dataset from <https://tiny-imagenet.herokuapp.com/>. With more involvement of different pictures from different categories, the trained model will be better. Therefore, we believe that when the dataset is more sufficient and various, the neural network will have better performance.

A screenshot of a cell phone

Description automatically generated

A screenshot of a cell phone

Description automatically generated

A screenshot of a cell phone

Description automatically generatedA close up of a bird

Description automatically generated