Single Image Dehazing via NIN-DehazeNet

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INTRODUCTION

- Image dehazing is a challenging problem in the field of computer vision. The purpose of Image dehazing is to recover a clear image from one single noisy frame caused by haze, fog or smoke.
- The dehazing algorithms have thus been widely considered, as a challenging instance of (ill-posed) image restoration and enhancement.
- The haze removal from one single image has now gained the dominant popularity, since it is more practical for realistic settings.

PROBLEM STATEMENT

- There are many methods evolved for overcome the fogging/haze in digital image.
  Proposed system is expected to give more clear and faster output.
- But those systems produce results are not much clearer. Also take more time to produce output.

LITERATURE REVIEW

Name of Paper	Authors	Description
• Single Image Dehazing via NIN-DehazeNet (2019)	• Kangle Yuan • Jianguo Wei • Wenhuan Lu • Naixue Xiong	• Based on above model Network in Network and MSCNN Model is implemented with different scales.
• Single Image Dehazing via Multi-scale Convolutional Neural Networks (2016)	• Wenqi Ren • Si Liu • Hua Zhang • Jinshan Pan • Xiaochun Cao	• A multi-scale deep neural network for single-image dehazing by learning the mapping between hazy images and their corresponding transmission maps.
• Single Image Haze Removal Using Dark Channel Prior (2011)	• Kaiming He • Jian Sun • Xiaoou Tang	• The dark channel prior is a kind of statistics of outdoor haze-free images. It is based on a key observation most local patches in outdoor haze-free images contain some pixels whose intensity is very low in at least one color channel.

OBJECTIVES

- To develop a system that is faster and simple.
- And a system able to produce a better dehazed image.
- Overall improve the quality of image take under bad weather.

PROPOSED SYSTEM

- This method estimates the transmission map by NIN-DehazeNet combining Network-in-Network with MSCNN(Single Image Dehazing via Multi-Scale Convolutional Neural Networks).
- In the test stage, we estimate the transmission map of the input hazy image based on the trained model, and then generate the dehazed image using the estimated atmospheric light and computed transmission map.
- The transmission map describes the portion of the light that is not scattered and reaches the camera. Since the map is a continuous function of depth, it thus reflects the depth information in scene.

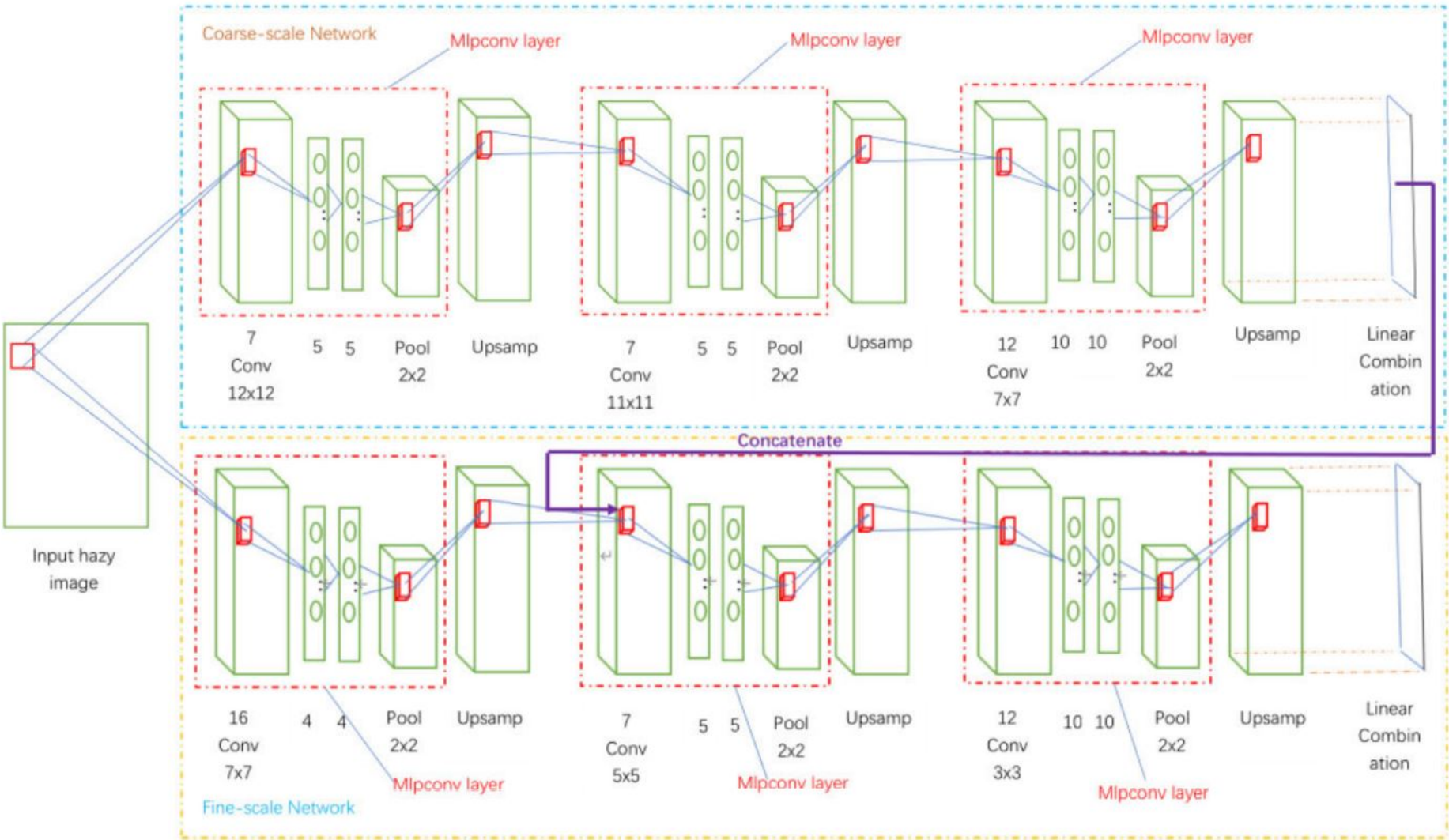
SYSTEM IMPLEMENTATION DETAILS

- RESIDE Dataset (clear,hazy,trans) available in kaggle is used to train the Model.
- NIN-Dehazenet has to be created,which is the combination of Network and Network with MSCNN.
- Trained Model is Intergrated with Flask.where user can input image and dehaze result is available next.

SOFTWARE AND HARDWARE SPECIFICATION

1. Hardware Requirement
   - Processor : Intel CORE i5
   - Hard Disk : 1 TB
   - Ram : 8 GB
   - Speed : 2.4 GHz
2. Software Requirement
   - IDE : PyCharm
   - Programming Language : Python
   - OS : Windows
   - Libraries : Numpy, Tensorflow, Keras

ARCHITECTURE



ARCHITECTURE

- The network contains two network: one coarse scale network and fine scale network.
- Each Layer contains three MLpconv Layer with different scales
- The MIpconv Layer contains :A conv layer ,two kernals ad maxpooling layers of different scales. which is called a micro network.
- Coarse-Scale Network:The task of the coarse-scale network is to predict a holistic transmission map of the scene. The coarse-scale network consists of four operations: convolution, max-pooling, up-sampling and linear combination.

ARCHITECTURE

- Fine-Scale Network:The architecture of the fine-scale network is similar to the coarse-scale network. Here the coarse output transmission map is used as an additional feature map.And it refine the features.
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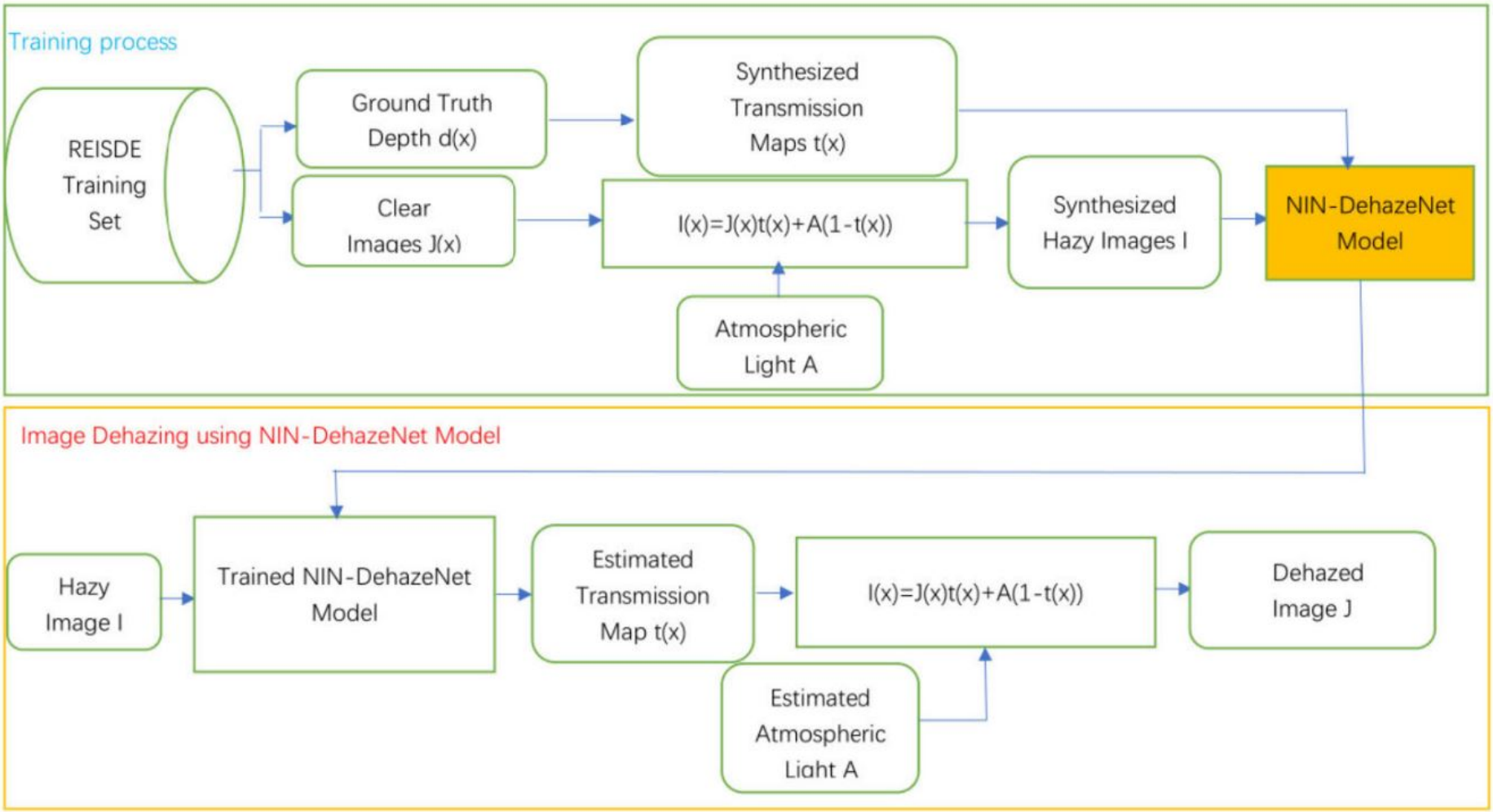
- Max-pooling: a maximum pooling layer is used after each convolutional layer.
- Up-sampling: an up-sampling layer is used after each pooling layer to ensure a transmission map of the output and an input foggy pattern equal in size.
- Linear combination: In this final layer, the feature channel from the last up-sampling layer is integrated by linear combination and the final output is obtained by the sigmoid activation function.

ARCHITECTURE

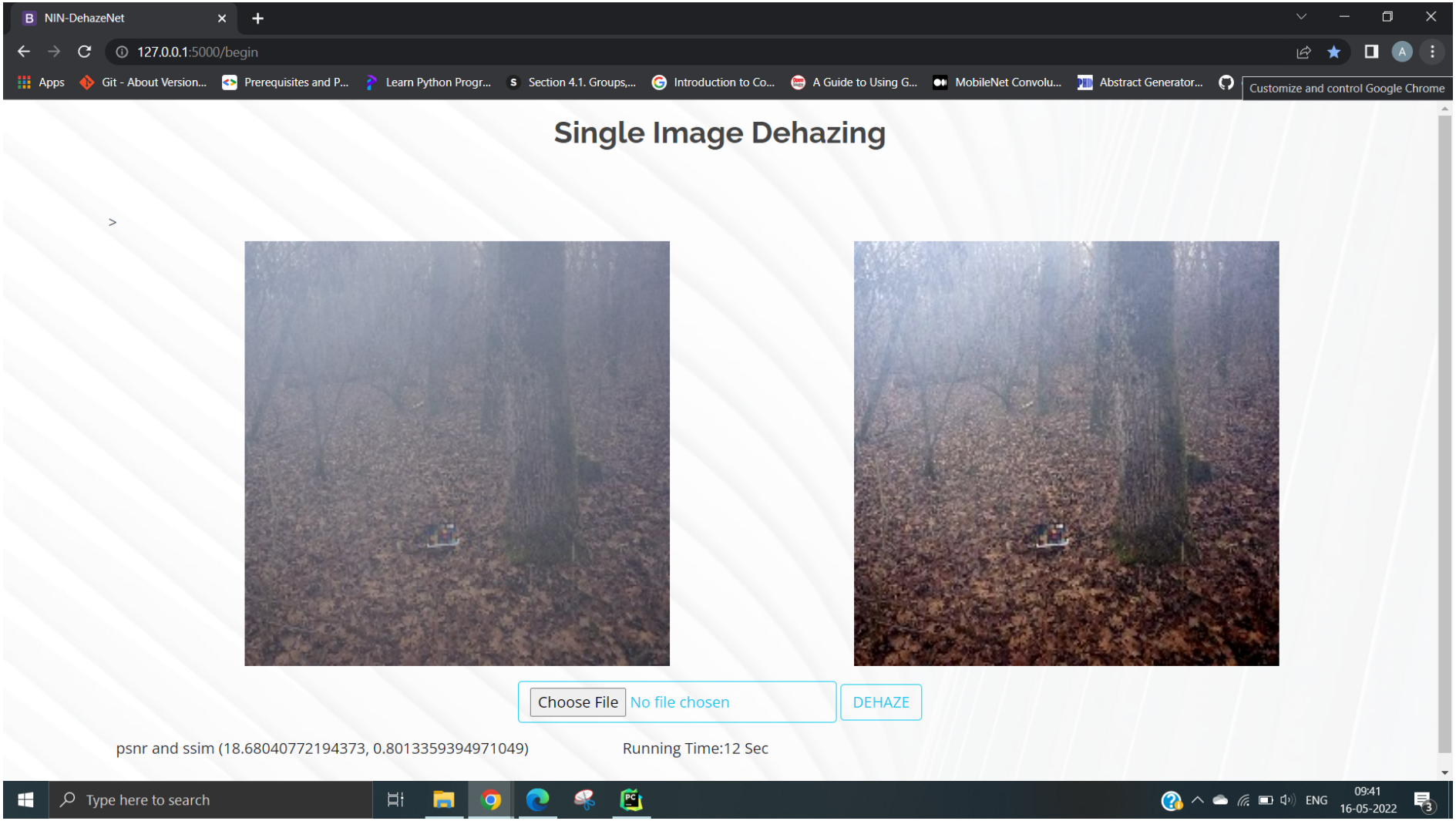


ARCHITECTURE

- To construct the clear image from hazy image we utilise this equation.
- $\boldsymbol{I(X) = J(X).t(X) + A(1 - t(X))}$
- A is the estimated Atmospheric light
- I(X) is Hazy Image
- J(x) is Clear Image
- t(x) is scene transmission describing light that not scattered.

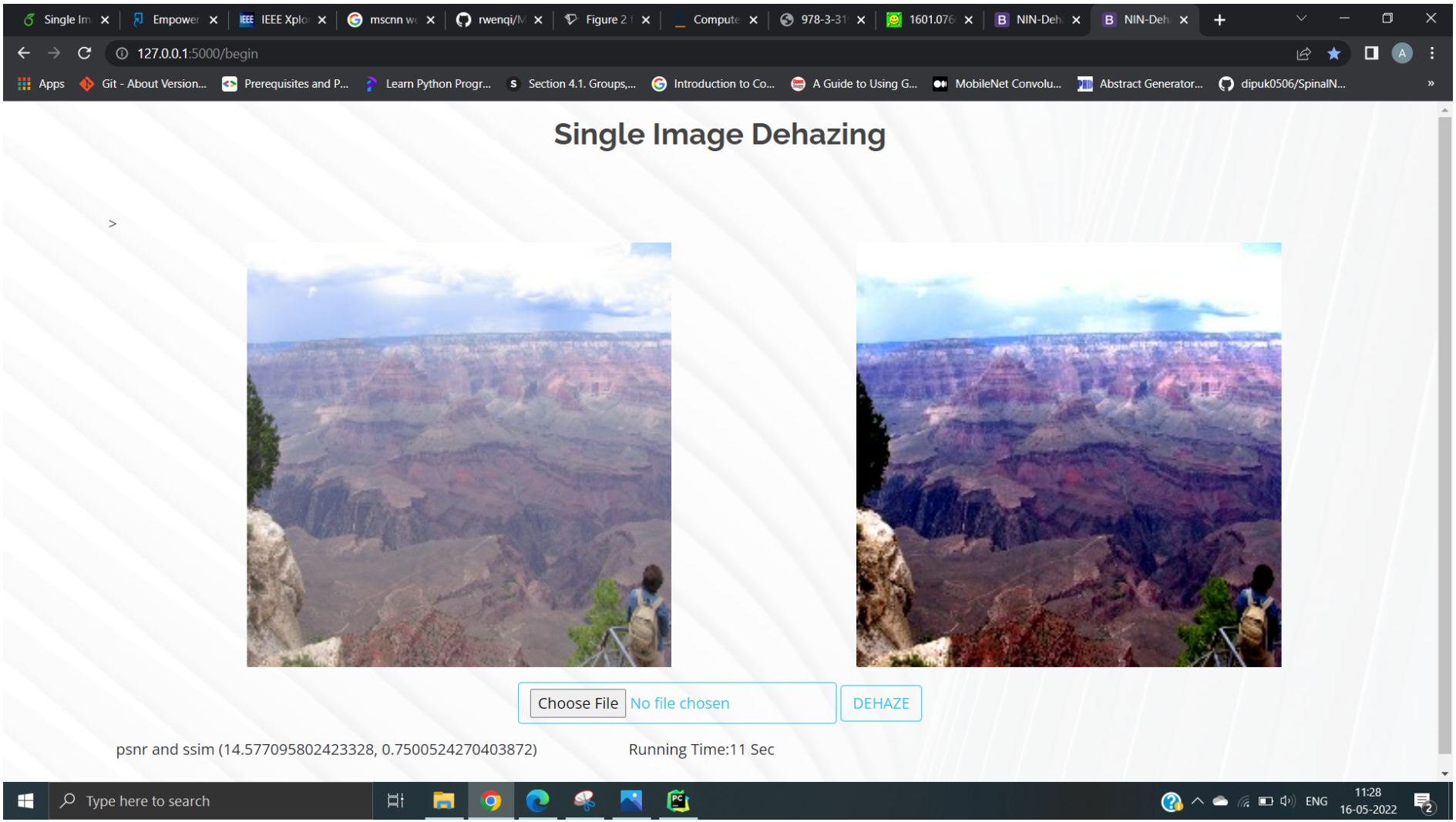
RESULT

Sample A.



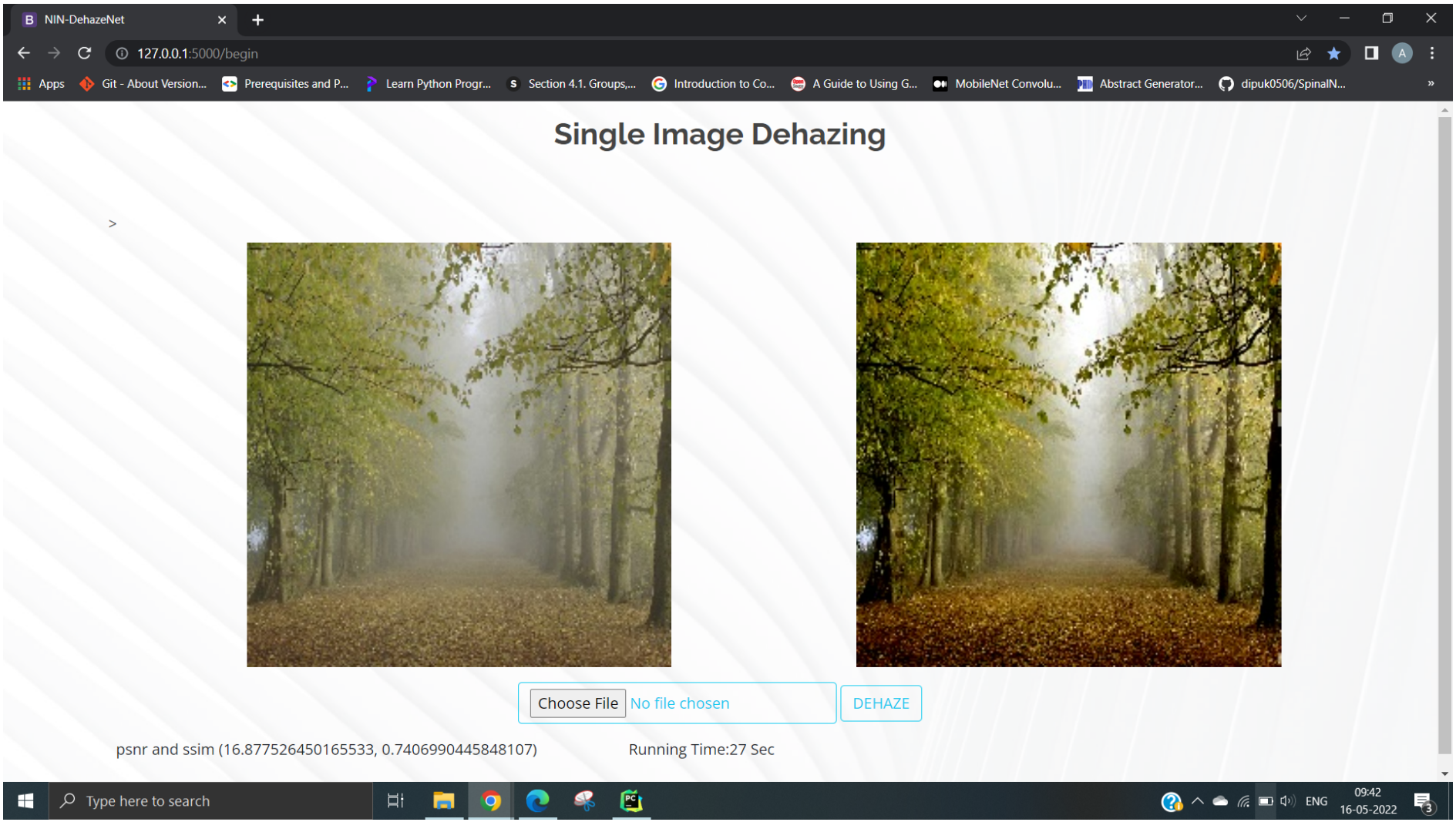
RESULT

Sample B.



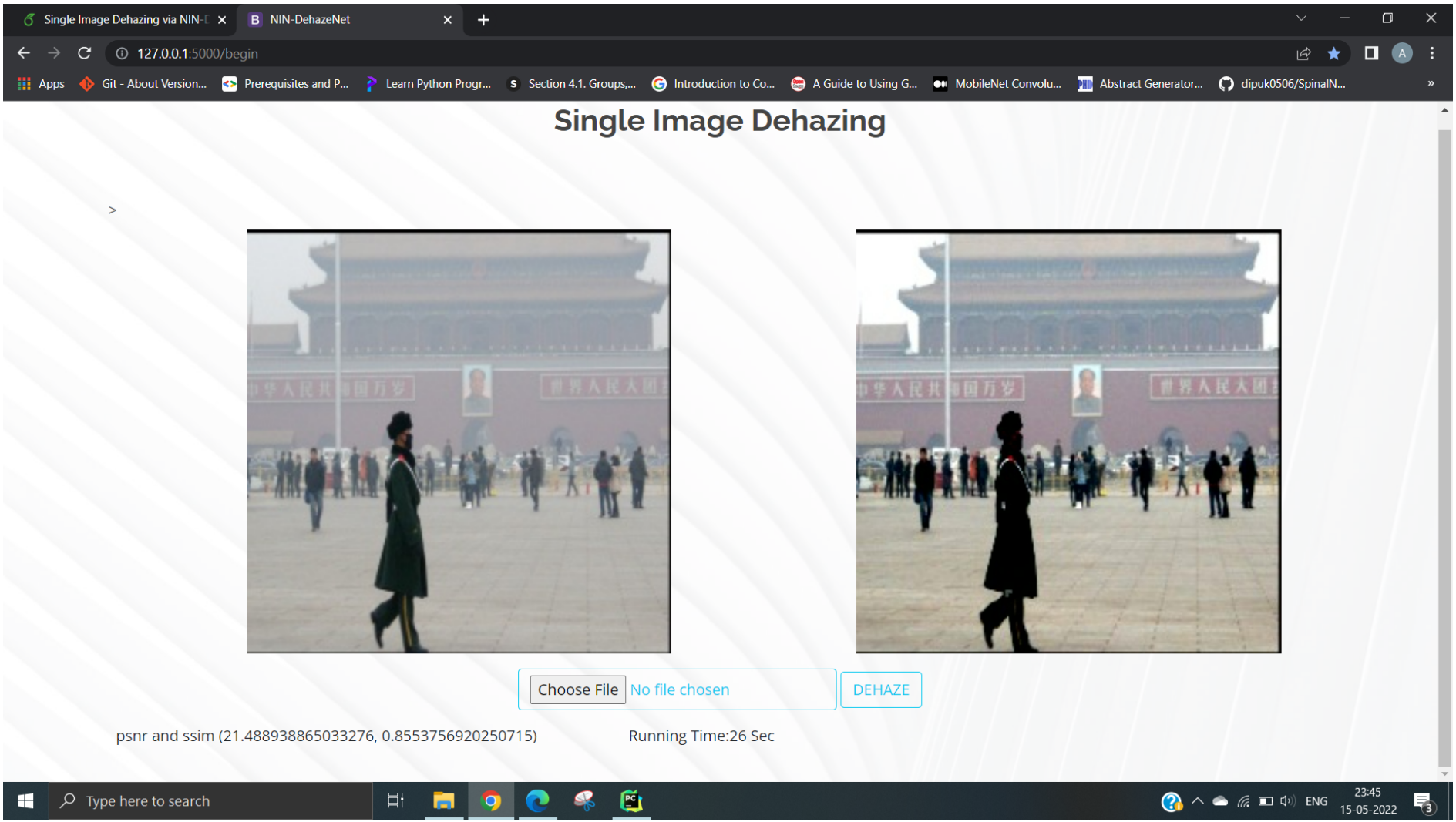
RESULT

Sample C.



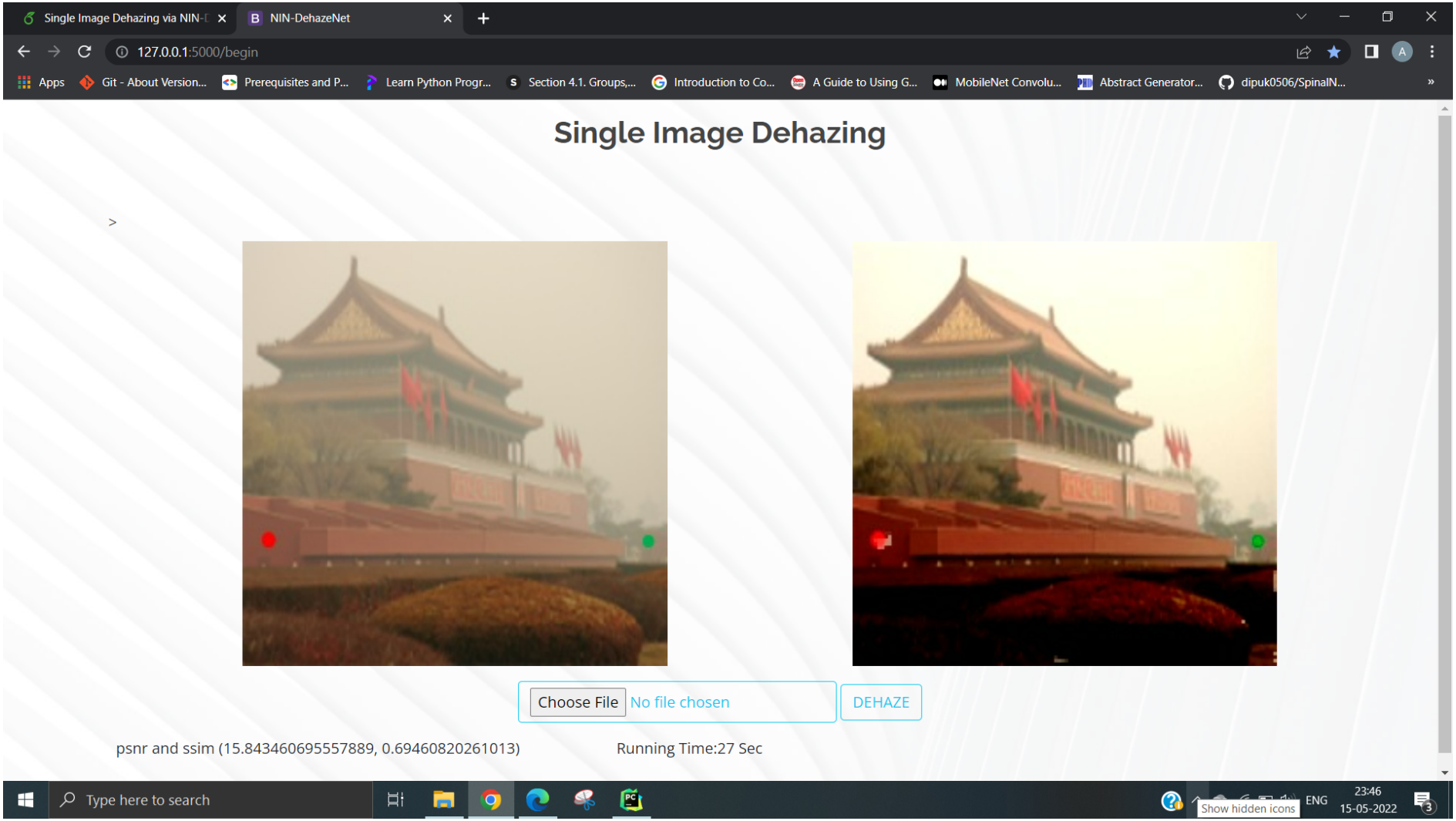
RESULT

Sample D.



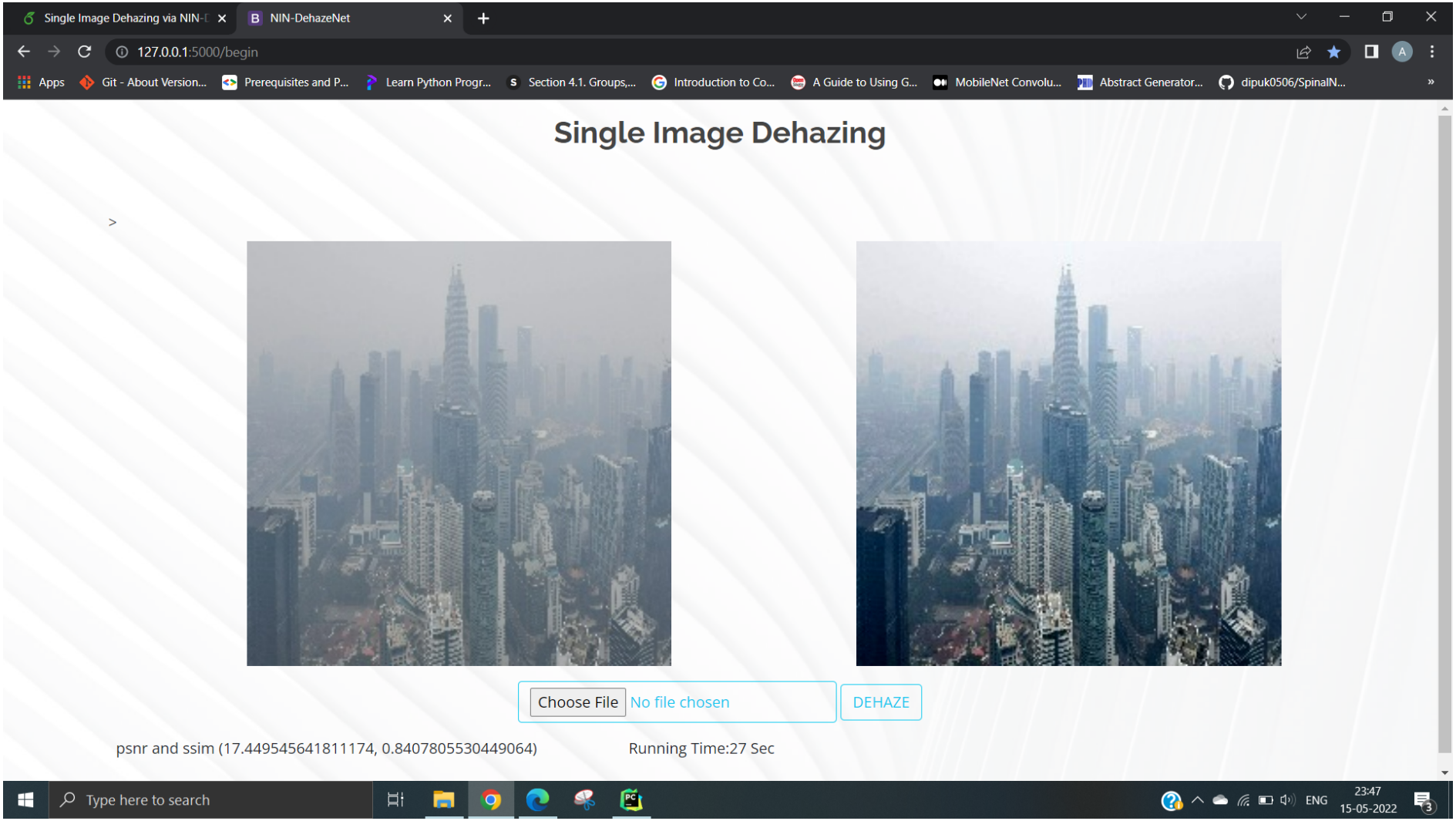
RESULT

Sample E.



RESULT

Sample F.



EVALUATION RESULTS

Sample	PSNR	SSIM	Running Time(seconds)
A	18.68	0.801	12
B	14.57	0.750	11
C	16.87	0.740	27
D	21.48	0.855	26
E	15.84	0.694	27
F	17.44	0.840	27

Evaluation

- Peak Signal to Noise Ratio(PSNR) and Structural Similarity Index Measure (SSIM)
- PSNR ratio is used as a quality measurement between the original and a compressed image.calculated in decibel
- The higher the PSNR, the better the quality of the compressed, or reconstructed image.
- SSIM is used as a metric to measure the similarity between two given images.
- The Structural Similarity Index (SSIM) metric extracts 3 key features from an image:Luminance,Contrast,Structure.
- SSIM value near to 1 is better value.
- Using libraries from skimage.measure we can evaluate PSNR and SSIM .

Future Scope

- It can be applied in real scenarios of video during foggy weather.
- The work can facilitate the automatic monitoring in Smart City applications.
- Monitoring Vehicle in traffic Control is useful
- Better visibility to drivers via camera
- Object recognition can be made easy
- Satellite imaging is other scope

References

- *Single Image Dehazing via NIN-DehazeNet* Kangle Yuan;Jianguo Wei;Wenhuan Lu;Naixue Xiong, IEEE Access Year: 2019
- *Single Image Haze Removal Using Dark Channel Prior* Kaiming He;Jian Sun;Xiaoou Tang, IEEE Trans. Pattern Anal. Mach. Intell., Year: 2011
- *Single Image Dehazing via Multi-scale Convolutional Neural Networks* Wenqi RenSi LiuHua ZhangJinshan PanXiaochun Cao, Springer, Oct. 2016

Thanks

THANK YOU