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School of Computer Science and Engineering

J Component report

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Title: Image Enhancement of Handwritten Examination Scripts

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Image Enhancement of Handwritten Examination Scripts

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***Abstract*—The deep learning model describes how the human visual system controls the hue and brightness of items seen by the eyes. This research proposes a deep network image enhancement approach based on image derived graphs for poor illumination images based on this idea. To begin, traditional image enhancement methods are used to process images to obtain derivative maps due to low contrast, low overall brightness, and blurred details of dark areas in images captured under weak illumination: adaptive contrast-limited histogram equalization, logarithmic histogram equalization, and adaptive gamma correction with weighted distribution. After that, a deep decomposition network is used to retrieve the picture illumination component. The end-to-end mapping relationship between low- and high-illumination images is trained, and the final output picture is improved the means of a deep enhancement network. In comparison to certain state-of-the-arts, the experimental findings reveal that the suggested method is more resilient, and the produced picture has richer details, stronger contrast, better visual effect, and image quality. In our project we are going to enhance the images of hand written answer scripts For better improvement in modern study. In this project we are taking answer sheets which are blurry as inputs and enhancing them using some deep learning models and giving enhanced answer scripts as outputs.**

***Keywords*—Deblurring, Noise, Sharpening**

I. Introduction

Due to the onset of the pandemic in 2019, all of us are now engaged in work/education remotely. Remote examination software products are in the trend with features like automated submission, noise and object detection, proctoring etc.

Students in such systems are generally expected to upload images of their answer scripts, for each of the questions. Due to exam coercion and uploading device limitations (like RAM, camera quality etc.), the answer script images recieved at the evaluator's end may be blurred/shaken. This makes the evaluation process difficult and students may therefore lose deserving marks.

By this blurred images there will be problems facing on both sides i.e., from the student side and from the evaluators side. If the evaluator didn't understand the answer it will be difficult to correct the answer and if evaluator completely didn't understand the answer then the evaluator will reduce marks sometimes they will give zero marks so the student will suffer now because he is getting lowest marks. So to avoid these problems we are trying to implement some deep learning models to enhance the answer scripts images.

The proposed system aims at developing model(s) for enhancing such images.

II. Related Work

6 latest references were reviewed as tabulated in Tab. I

III. Dataset

Although digitalisation is in the trend, handwritten examinations are comfortable. There is always a need for handwritten text recognition (HTR) models to automate evaluations. It is also challenging because of the virtually infinite number of ways a letter/word can be written by the very same person. We use dataset named Kazakh Offline Handwritten Text dataset. It consists of 3000 handwritten documents, more than 140335 image segments and approximately 922010 symbols.

IV. Approach

Since not all images are blurred or have some distortion in them, we add Gaussian Blur manually.

We have used Super Resolution Convolutional Neural Networks (SRCNN) to produce high resolution deblurred image from single low-resolution blurred image. The architecture is depicted below:

The SRCNN architecture has a total of three convolutional layers. First convolution operation has weight matrix of shape c x f_1 x f_1 x n_1, where f_1 and c refer to the number of kernels and neurons respectively. Second convolution operation has a weight matrix of shape n_1 x 1 x 1 x n_2. Here the kernel size is 1 x 1. Final convolution operation has a weight matrix of shape

TABLE I: Literature Review

S.No.	Title	Main Findings	Dataset used	Advantages	Disadvantages	Future Problems
[1]	A survey On Deep Learning Based Document Image Enhancement	Dealt with Binarization, deblurring, denoising, defading, watermark removal and shadow removal	Bishop Bickley Diary; NoisyOffice S-MS Tobacco 800; DIBCO '17 H-DIBCO '17 SmartDoc-QA Blurry Document Images	Dataset explained very clearly, with mention about evaluation metrics	Too many datasets used	Overexposure and underexposure super-resolution OCD perfomance and evaluation
[2]	Binary handwriting image enhancement by directional field-guided morphology	Improvemnt to binarization process Approach involves morphological dilation process, local adaptation, directional field (gradient operators), and circular histogram	Grayscale image-CEDAR Handwritten image-DIBCO	Binarization process made more efficient; considers the direction or orientation of writing. Evaluation metrics are clear	-	-
[3]	Deblurring Text Images using Kernel Dictionaries	New approach to represent and computing blurring kernel Involves derivative and gradient terms	Not mentioned	Involves fundamental image processing operations; Evaluation metrics are explicitly clear	Dataset used not mentioned or shared	-
[4]	Document DeepOtsu enhancement and binarization using iterative deep learning	Approach involves Reccurrent and Stacked Refinement	H-DIBCO DIBCO Bickely-diary PHIDB Synchrome-dia Multispectral dataset	A more complicated neural network could perform the initial iterations, while a lighter neural network could be used in the final iterations for fine-tuning evaluation metrics mentioned	-	-

TABLE I: Literature Review

[5]	An enhanced binarization framework for degraded historical document images	Contrast or edge-based segmentation Energy-based segmentation Statistical learning-based segmenta-tion Deep learning-based segmentation Laplacian energy-based segmenta-tion,and MPM (misclas-sification penalty metric), mathematical morphology	DIBCO and H-DIBCO Recognition and Enrichment of Archival Documents (READ) project	Binarization process improved	-	Improve the contrast between text and background by using machine learning or deep learning techniques to effectively achieve degraded document image enhancement in the preprocessing stage.
[6]	An Improved Method for Handwritten Document Analysis using Segmentation, Baseline Recognition and Writing Pressure Detection	Segmentation, Baseline Recognition and Writing Pressure Detection	IAM	Line & Word Segmentation Skew Normal-ization Writing Pressure Algorithms explained clearly along with data set Personality Prediction algorithms	-	The future work can include more handwriting features with the proposed method like character recognition and some other personality traits.

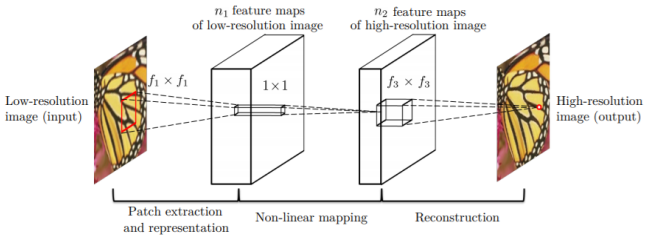

Fig. 1: Layers of SRCNN

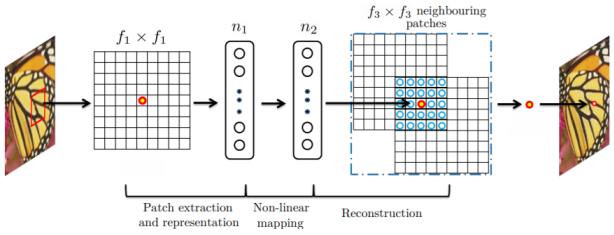

Fig. 2: Patch extraction and image reconstruction using SRCNN

n_2 x f_3x f_3x c. Among all those three convolution operations, ReLU (Rectified Linear Units) activations are applied to the first two convolution operations.

V. Results and Discussion

Aim of our model is to produced super resolution deblurred images of handwritten answer scripts.

The Super Resolution Convolutional Neural Network produced excellent results in that regard.

The neural network was run for 10 epochs. At the end of 10 epochs, we produced a train and validation loss of 32.4 % and and 32.1 % respectively.

Our model inputs and outputs are shown in Fig. 4.

VI. Conclusion

Due to pandemic all of us have resorted to remote learning and online examinations. In such situations there might be issues where students might lose marks where they deserve. This can be due to various issues like panic, device issues, network issues etc. To overcome this problem, an image enhancement model likes ours can be embedded into online exam portals for the betterment of students and ease of correction for faculties.

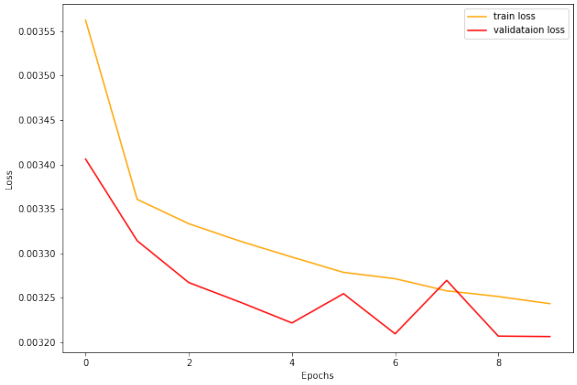

Fig. 3: Train and Validation Loss

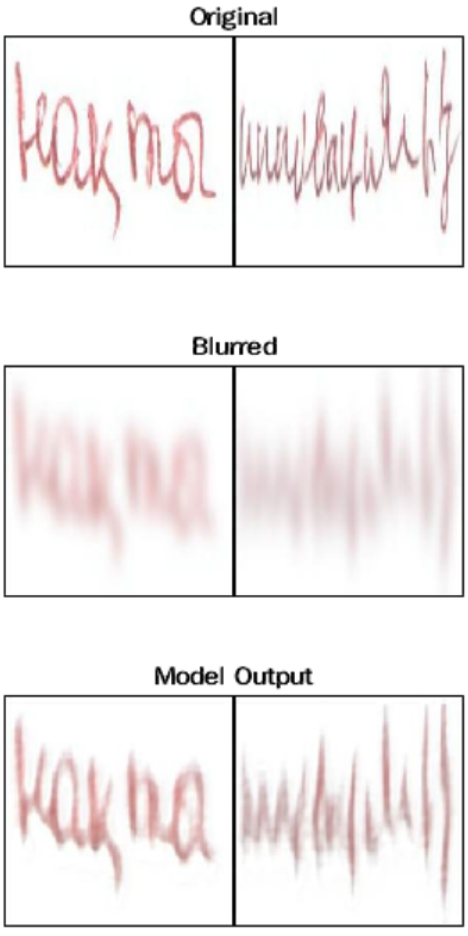

Fig. 4: Model Results

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