## **Report on Project 5**

## **Image Transcription**

In this assignment the input was an image with texts and the output is save the texts into a file. I followed the following steps:

- 1. Denoise the image by using one of the non-filtering. I used bilateral filtering in this case.
- 2. Binarize the image by setting the pixel values to one for pixels larger than a threshold. (I used 0.75 as threshold)
- 3. Then I got the connected components of the binary image by using skimage.measure.label
- 4. After that we filtered the connected components. We only took the components with following properties:
  - a. Convex area / area > 0.95
  - b. area > 200
- 5. Then the filtered regions are sorted because they are not in order. I followed the following steps:
  - a. First, I sorted the regions by the y min coordinate of the bounding boxes.
  - b. Replaced the similar y min values with same y min values.
  - c. Each unique y\_min values is in the same line of text. So, we separated the regions with same y\_min values to differentiate regions according to their lines.
  - d. Each list of regions i.e., each line of text is sorted by the x\_min of the bounding box values.
  - e. Finally, each list of regions is concatenated again.
  - f. Track the position of the ending of each list of regions to add line break in output file.
- 6. Then the regions are preprocessed to get the trained model prediction.
  - a. Crop each region according to their bounding box.
  - b. Pad the cropped images with zero by 10 pixels using **np.pad**
  - c. Apply bilateral filtering to remove noises.
  - d. Resize the padded images to (28, 28) using **skimage.transform.resize**
- 7. Get predictions for each preprocessed images and save them to a file. Then calculate the accuracy of the prediction by comparing the predictions with the ground truths.
- 8. I also set up an algorithm to check for spaces after each index.
  - a. Calculated the difference between x max and x min value of two consecutive regions.
  - b. The differences are sorted and the value which is greater than 90% of all the differences is selected as threshold.
  - c. Then the index the difference values greater than the threshold value are considered as spaces.

Some sample outputs are given below:

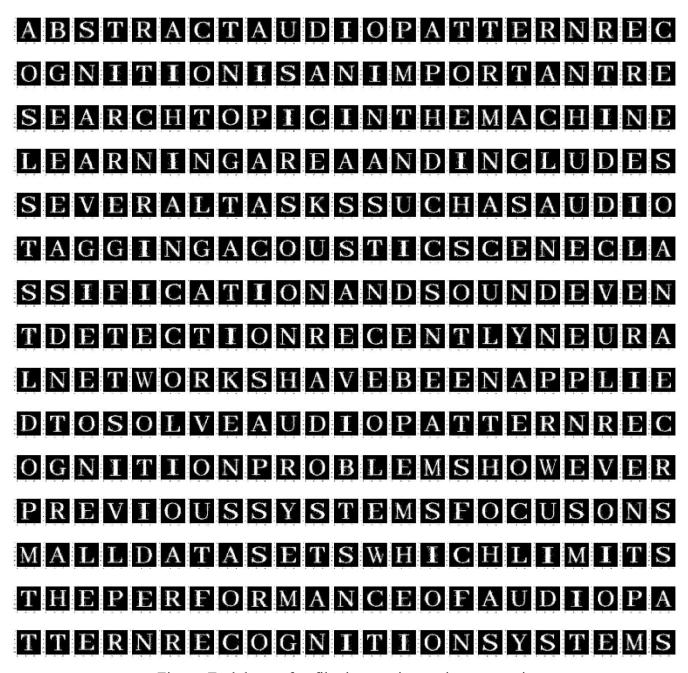


Figure: Each letter after filtering, sorting, and preprocessing.

ABSTRACT AUDIO PATTERN RECOGNITION IS AN IMPORTANT
RESEARCH TOPIC IN THE MACHINE LEARNING AREA AND INCLUDES
SEVERAL TASKS SUCH AS AUDIO TAGGING ACOUSTIC SCENE
CLASSIFICATION AND SOUND EVENT DETECTION RECENTLY NEURAL
NETWORKS HAVE BEEN APPLIED TO SOLVE AUDIO PATTERN
RECOGNITION PROBLEMS HOWEVER PREVIOUS SYSTEMS FOCUS ON
SMALL DATASETS WHICH LIMITS THE PERFORMANCE OF AUDIO
PATTERN RECOGNITION SYSTEMS

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RESEARCH TOPXC INRUE MACHINB NEARNINCDREAAND INCLUDLS
SLVERAL TASKS SUCH AS AUDIO RACGXNGACOUSTIC SCHNL
CLASSIRXCATIONAND SOUND EVENT DERLCTXON RECENRLY NEUKAL
NLRWORKS HAVE BEENAPPLIRD TO SOLVEAUDIO PARRLKN
KECOGNXTION PROBXLMS HOWEVBR PREVIOUS SYSREMS ROCUS ON
SMALN UARDSERSWHICH LXMIRS RHL PBKRORMANCE ORAUDIO
PART LRN RE C O CNX RI ON SYSTEM S

LOW CARBOHYDRATE DIETS HAVE BECOME INCREASINGLY POPULAR SUPPORTERS CLAIM THEY ARE NOTABLY MORE EFFECTIVE THAN OTHER DIETS FOR WEIGHT LOSS AND PROVIDE OTHER HEALTH BENEFITS SUCH AS LOWER BLOOD PRESSURE AND IMPROVED CHOLESTEROL LEVELS HOWEVER SOME DOCTORS BELIEVE THESE DIETS CARRY POTENTIAL LONG TERM HEALTH RISKS ARE VIEW OF THE AVAILABLE RESEARCH LITERATURE INDICATES THAT LOW CARBOHYDRATE DIETS ARE HIGHLY EFFECTIVE FOR SHORT TERM WEIGHT LOSS BUT THAT THEIR LONG TERM EFFECTIVENESS IS NOT SIGNIFICANTLY GREATER THAN OTHER COMMON DIET PLANS THEIR LONG TERM EFFECTS ON CHOLESTEROL LEVELS AND BLOOD PRESSURE ARE UNKNOWN RESEARCH LITERATURE SUGGESTS SOME POTENTIAL FOR NEGATIVE HEALTH OUTCOMES ASSOCIATED WITH INCREASED CONSUMPTION OF SATURATED FAT THIS CONCLUSION POINTS TO THE IMPORTANCE OF FOLLOWING A BALANCED MODERATE DIET APPROPRIATE FOR THE INDIVIDUAL AS WELL AS THE NEED FOR FURTHER RESEARCH

LOW CAKBOHYNRARB BIERS HAVE BLCOMF INCREASXNGLY POPUIAR SURPORRERS CXAIM RHEYAKE NOTABLY MOKE EFFECTXVB THAN ORHKRBIETS FORWEXCHR HOSSANU PROVIBE ORHEK HBAHRH BENEFKRS SUCH AS XOWERBXOOU PRESSURE ANB IMPKOVEB CHOXESTEROHHBVELS HOWKVERSOME DOCTORS BEXIEVE THESE DIETS CARRXPORENRIAL XONG RERM HEAITH RXSKS ARE VIEWOFRHE AVAIXABHE RESEARCH HITERARURE XNBICARES RHAR HOWCARBOHXURARE BIETSAKE HIGHXY ERFECTXVE FOR SHORT RERM WEIGHR XOSS BUR THAR RHEXR XONGRERM KFFECTIVENESS XSNOR SIGNIFICANRLY CREAREK THAN OTHER COMMON BXER RXANS THEXRLONC RFKM EFRECTS ON CHOXESTEKOXXEVELS ANB BXOOU PRKSSURE ARK UNKNOWN KESEARCH LITERATURE SUCCESRS SOME PORENRIAL FORNEGATXVL HEALTH OURCOMES ASSOCIAREB WIRH INCREASEU CONSUMPRXON OF SARURARFD FAR THIS CONCXUSION POINRS RORHE IMPOKRANCE OE FOHNOWINGA BAXANCEB MOUERATE NXET APPROPRIARE ROK RHE XNUIVIBUAXAS WELLAS RHB NEED FOK RURRHER RKSEARCH

Figure: Left side is the input image. Right side is the models output written in a text file after running our full preprocessing pipeline.