

Facial Expression Recognition
COMP 472
Artificial Intelligence

Group: AK_19

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Repository: https://github.com/Artypuppet/Image_Recognition_Project

We certify that this submission is the
original work of members of the group and meets the Faculty's Expectations of Originality.

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1 Dataset

1.1 Overview

The existing dataset we used is the *fer2013* dataset.

The dataset contains a total of 35,887 images. This project makes use of 20,140 images out of those 35,887.

Here is the distribution per class of those 20,140 images:

Angry – 4,953

Neutral – 6,198

Happy – 8,989

This dataset mostly contains close-up frontal face shots. All the images are in grayscale.

1.2 Justification

This dataset was chosen because it comes with a well-organized .csv file that contains all the relevant information we need. The .csv file contains three columns: emotion, pixels and usage (training or validation). This allows us to read and manipulate the data easily.

On top of the .csv file, the dataset also contains all of the .jpg files, allowing us to properly visualize what the dataset actually looks like. Upon inspection, one will notice that every image has the same dimension (48×48), which is perfect in order to ensure consistency when training our model.

This dataset is relevant because it covers three out of the four emotions we will be evaluating. It comes with a hefty number of images in each class, and the format of said images is consistent, allowing us to have a robust model.

The only challenge that this dataset might present is the absence of the *focused* class. In the *Labeling* section, we will discuss how we overcame this challenge.

1.3 Provenance Information

	Link	License	Owner
fer2013 (.csv)	https://www.kaggle.com/datasets/deadskull7/fer2013	CC0: Public Domain	Rohit Verma
fer2013 (.jpg)	https://www.kaggle.com/datasets/ananthu017/emotion-detection-fer/data	CC0: Public Domain	ARES (Alias)

2 Data Cleaning

The first step of data cleaning involved filtering the *fer2013* .csv file, as it included emotions that we would not be evaluating. Doing so was a relatively straightforward task: delete rows that had unwanted emotions. The python script that accomplished said task can be found in the *part_1/data_cleaning_labeling/scripts/filtering_unwanted_emotions.py* directory of the repository. The resulting .csv file can be found in the *part_1/data_cleaning_labeling/data/data_v1_filtered_emotions.zip* directory of the repository.

The second step of data cleaning involved formatting our twelve personal images to fit the format of the *fer2013* dataset, which was the biggest challenge so far when it came to data cleaning. To do so, we would need to resize our images to a 48×48 format and convert it to grayscale. The formatted images were written to a .csv file, all the while ensuring that the columns present matched the columns found within the *fer2013* .csv file. This was done with the python script found in the *part_1/data_cleaning_filtering/scripts/personal_images_formatting.py* directory of the repository.

Before (Left) & After (Right): Personal Image With a Neutral Face



As previously mentioned, the images present in the *fer2013* dataset all had a consistent format, meaning that it was not necessary to clean the data found within it. Everything was already standardized.

3 Labeling

When it came to the *angry* and *happy* classes, the dataset we used had them properly labeled already, meaning that no adjustments were needed.

As for the *neutral* and *focused* classes, some labeling had to be done. As previously mentioned, the *fer2013* dataset did not contain a *focused* class. The main challenge here was to find a way to populate the *focused* class.

Looking for solutions to said problem, we quickly realized that the distinction between *neutral* and *focused* is quite ambiguous. One can easily be confused for the other. As a solution, we decided to establish a clear criterion to distinguish these two classes: the *neutral* class would contain images with *relaxed* eyebrows, while the *focused* class would contain images with *tense* eyebrows.

This meant that the *neutral* class would need to be relabeled according to our new criterion. The plan was to go over the images found within the *neutral* class. Any image that had *relaxed* eyebrows would remain in the *neutral* class. Any image that had *tense* eyebrows would be moved to the *focused* class.

To accomplish this as efficiently as possible, a python script was used that prompts the user all of the images of the *neutral* class one by one. With each image displayed, the user is given one of three choices: the image remains in the *neutral* class, the image moves to the *focused* class, or the image is completely removed (for cases where the image does not fit either of the categories). The .csv file is modified accordingly based on the user's choice. The aforementioned python script can be found in the `part_1/data_cleaning_labeling/scripts/neutral_focused_distinction.py` directory of the repository.

When it comes to our own personal images, the .csv file that was previously produced (see previous section) was merged with the *fer2013* .csv file using the python script found in the `part_1/data_cleaning_labeling/script/personal_images_formatting.py` directory of the repository. The script makes use of the *pandas* library to accomplish said task.

4 Data Visualization

4.1 – Class & Pixel Intensity Distribution

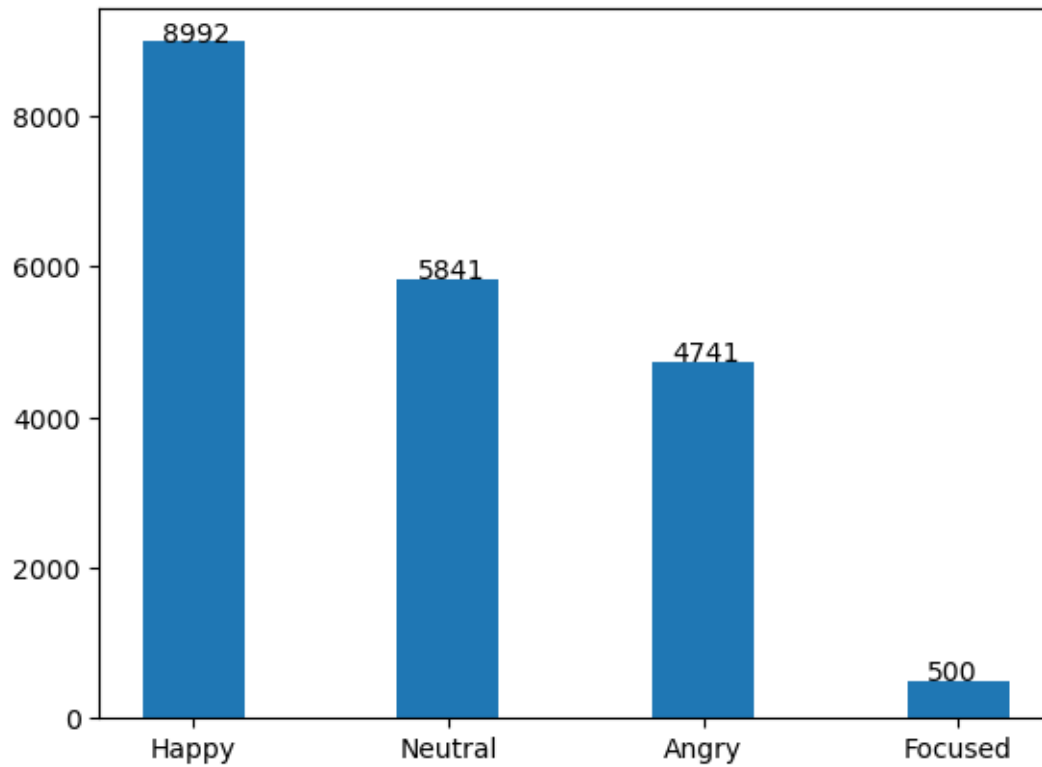


Figure 1. Distribution of Images across all the emotion classes.

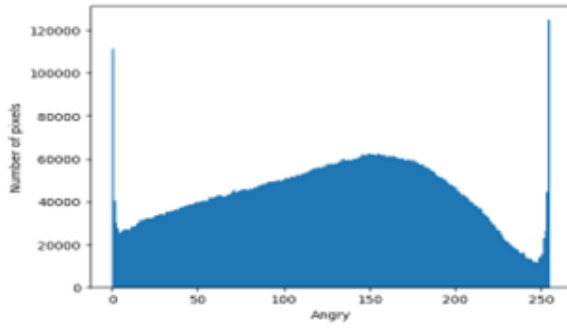


Figure 2. Pixel Intensity Distribution for "Angry" Emotion class.

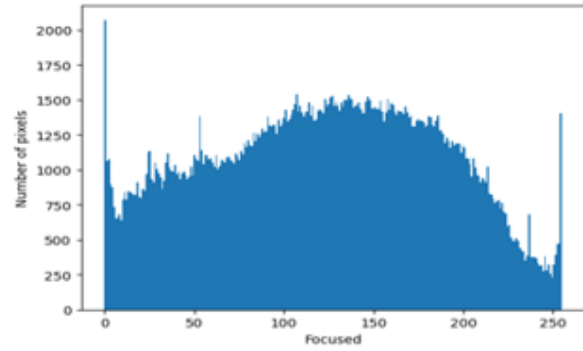


Figure 3. Pixel Intensity Distribution of "Focused" Emotion class.

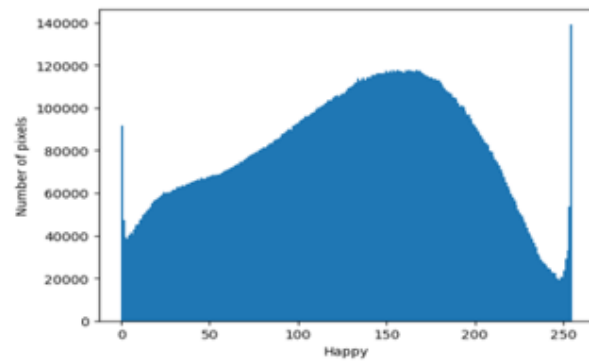


Figure 4. Pixel Intensity Distribution for "Happy" emotion class.

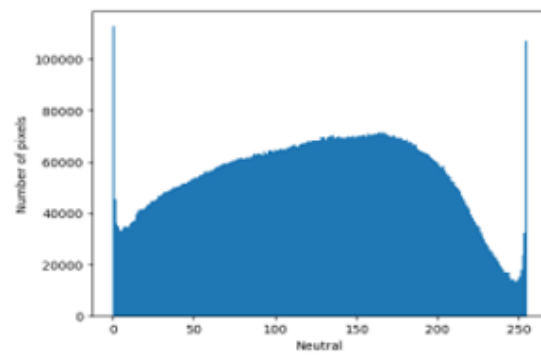


Figure 5. Pixel Intensity Distribution for "Neutral" Class

4.2 Sample Image

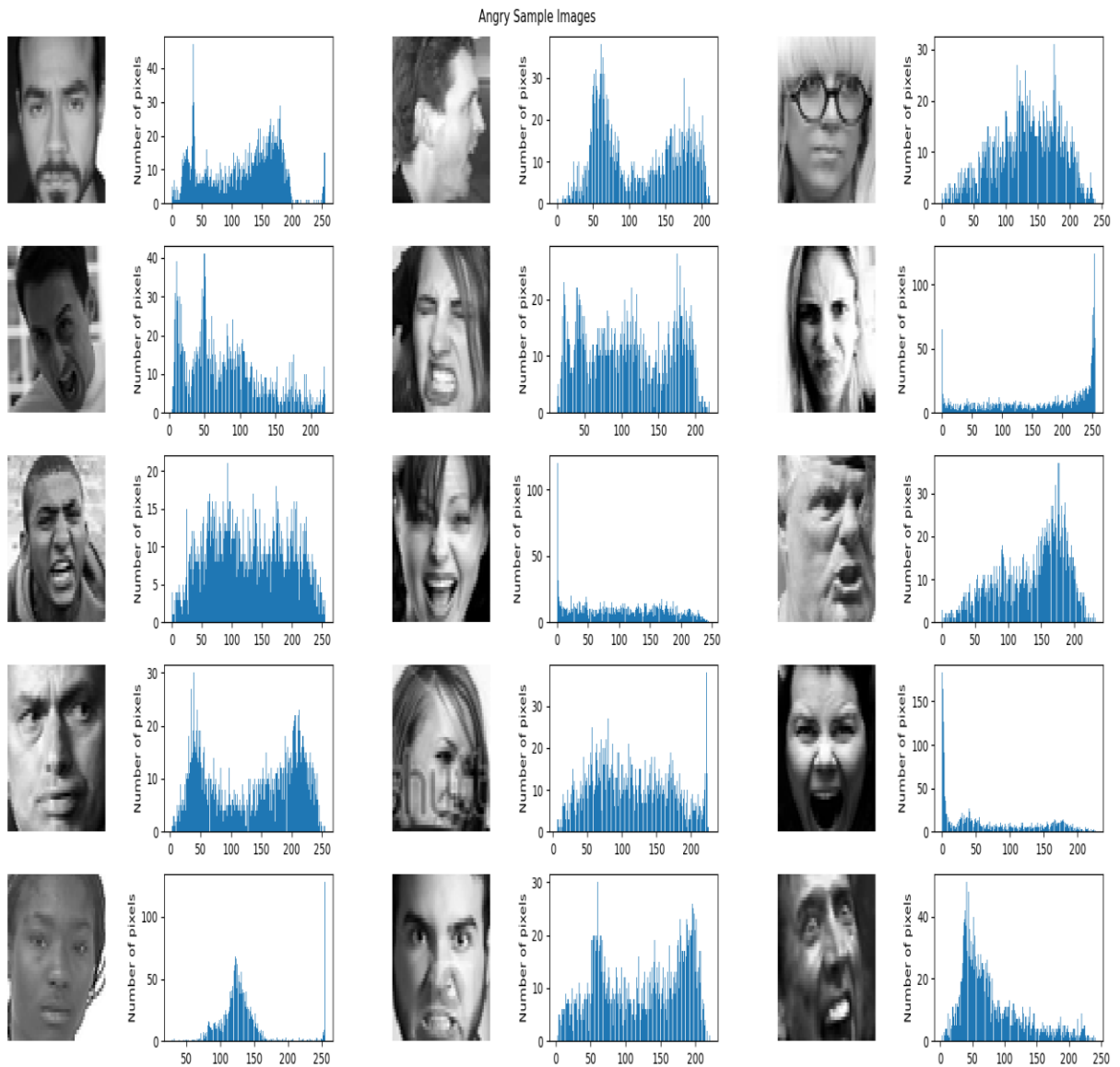


Figure 2. Pixel Intensity Distribution for Sample Images from "Angry" emotion class.

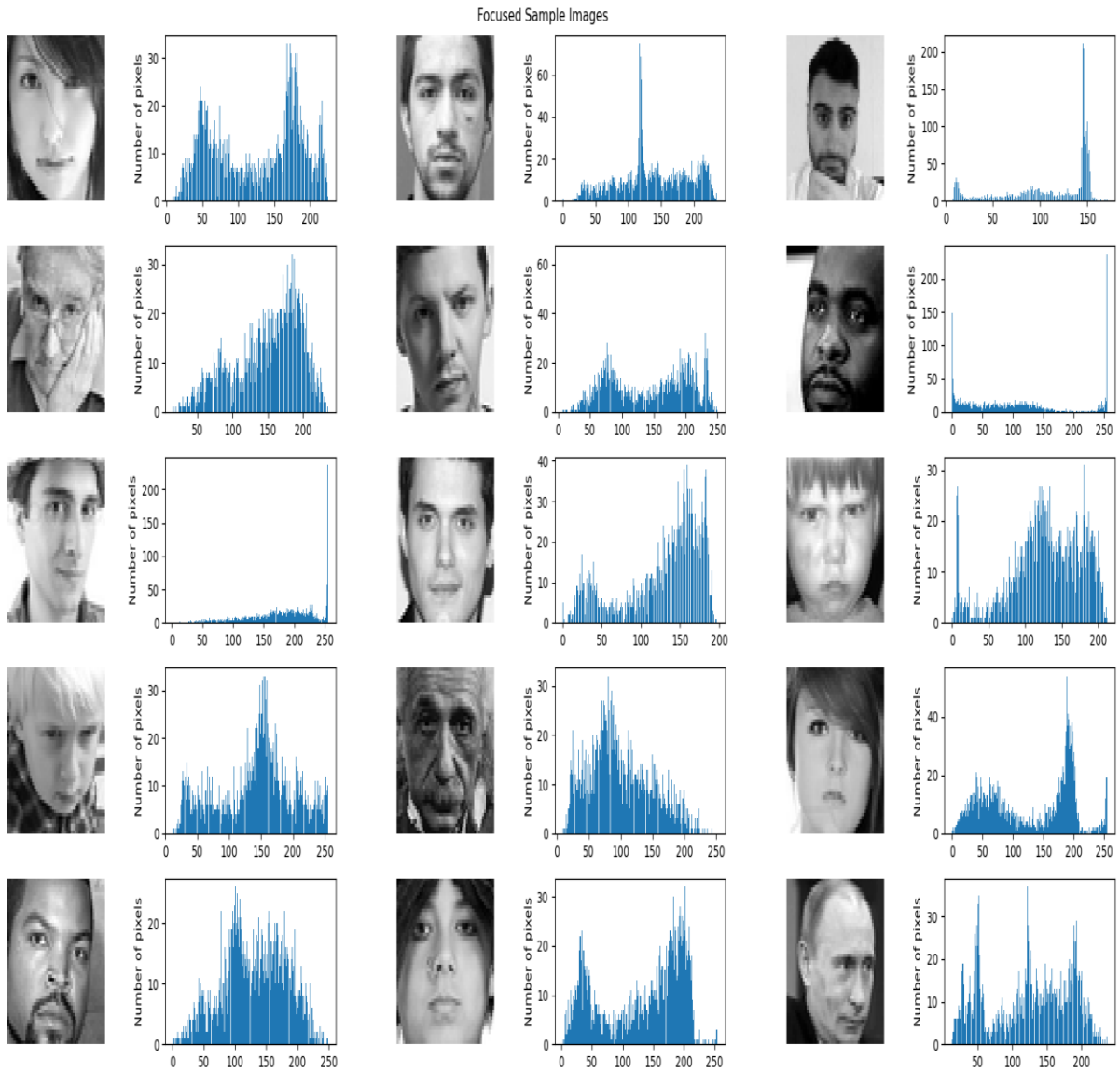


Figure 3. Pixel Intensity Distribution for sample images from "Focused" emotion class.

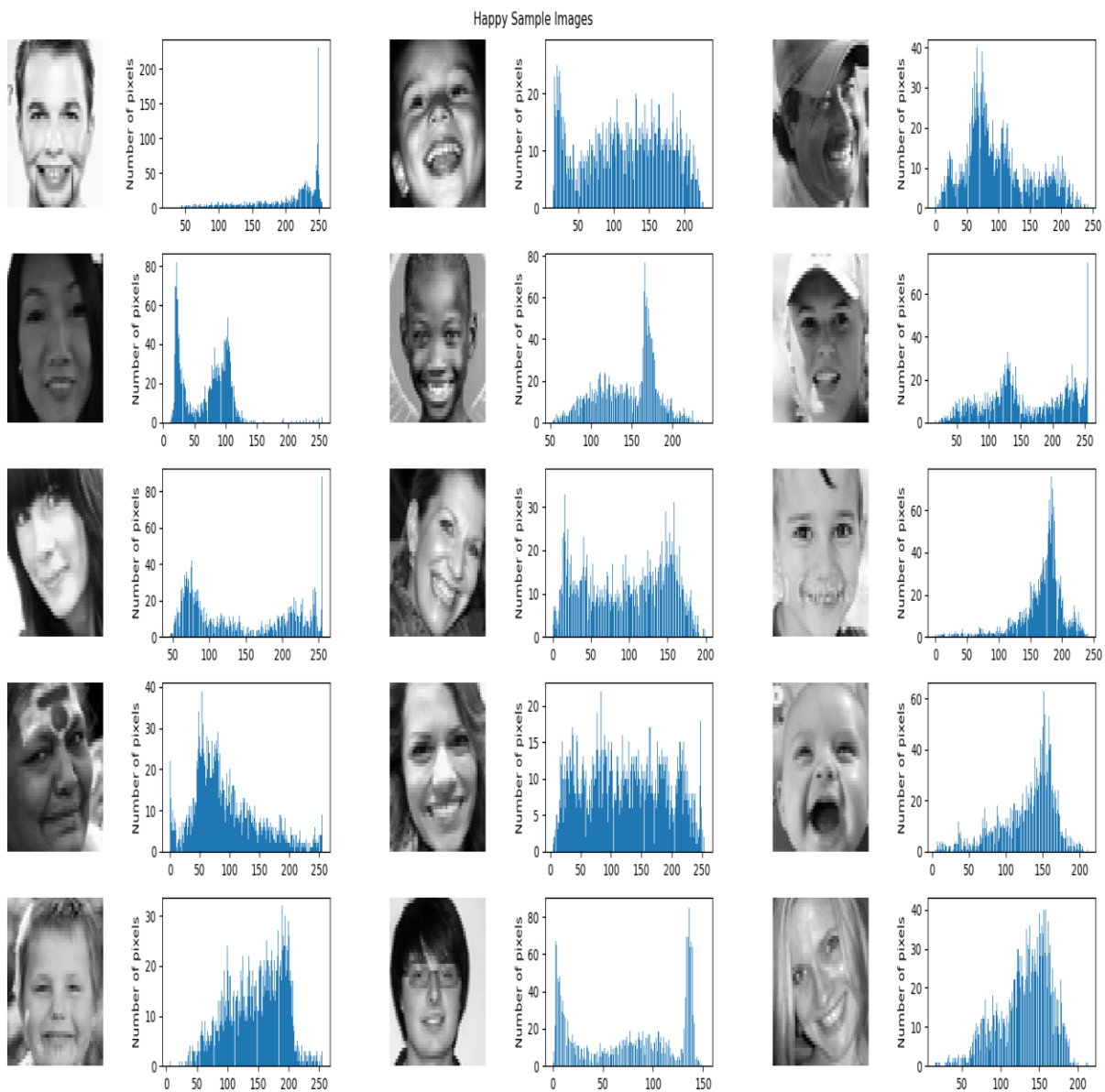


Figure 4. Pixel Intensity Distribution for sample images from "Happy" emotion class

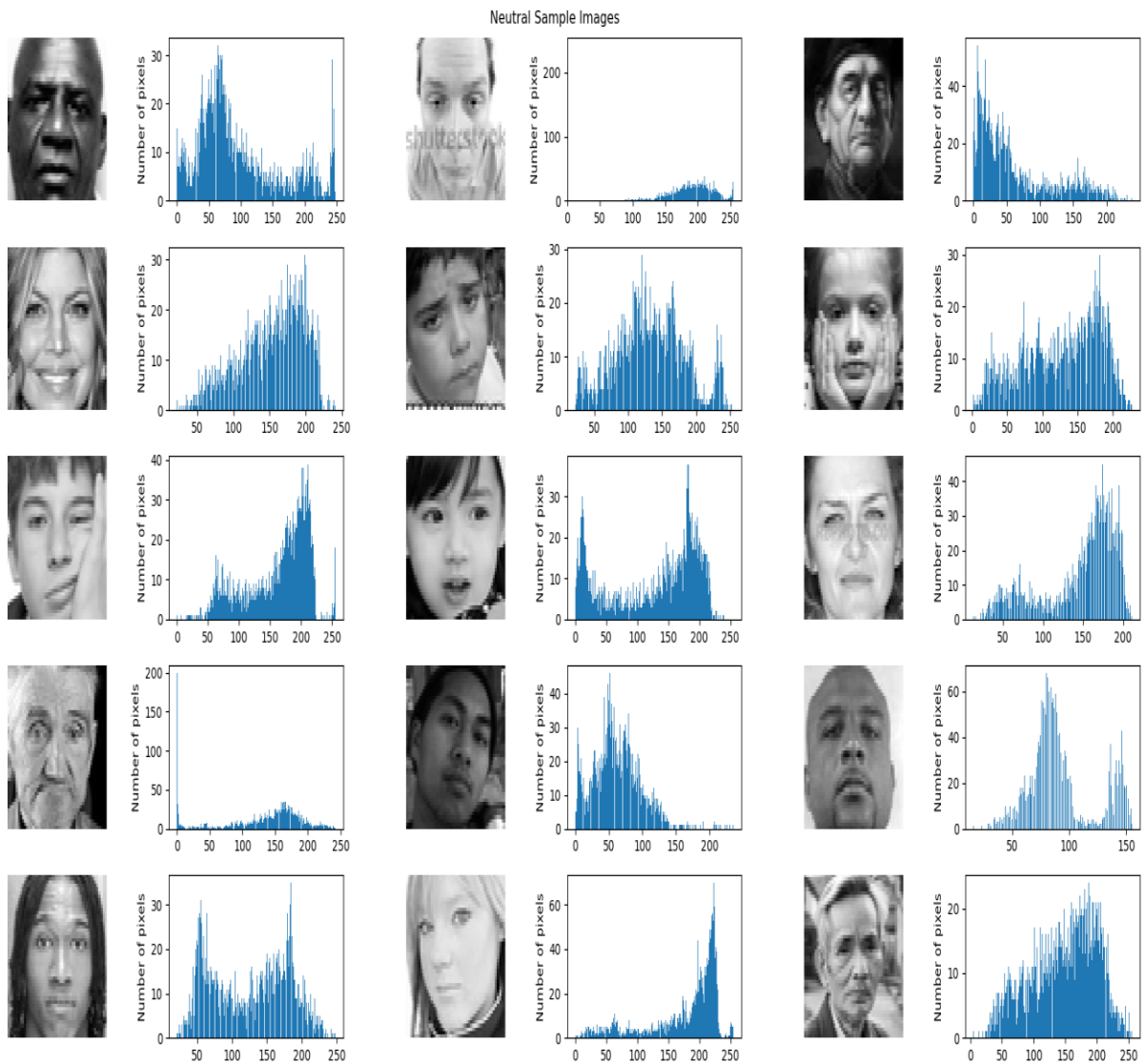


Figure 5. Pixel Intensity Distribution for sample images from "Neutral" emotion class

5 References

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