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**LAB WORK nO. 1**

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# ABSTRACT

This work shows the tradeoffs between quality and size for different image and video formats. The experiments performed follows this order:

1. Images/Videos are saved using OpenCV
2. Images/Videos are converted to grayscale
3. Each Image/Video (both grayscale and normal) are converted to different formats
4. The data is aggregated to a table
5. The data is drawn in a graph
6. Results/Conclusions are made

# TASK: IMAGE TRANSFORMATION

Images used for transformation were obtained using the camera from my Lenovo Yoga Slim 7 inbuilt camera (exact model not known). To obtain the images OpenCV Python bindings library was used.

To keep the environment conditions as static as possible the room had all the blinds closed, and used a lamp for illumination. Additionally the images were taken in rapid succession using a for loop (1).

|  |  |
| --- | --- |
| images = [[\*camera.read(), i] for i in range(5)] | (1) |

These images were then transformed to grayscale using OpenCV library (2).

|  |  |
| --- | --- |
| gray = cv2.cvtColor(img, cv2.COLOR\_BGR2GRAY) | (2) |

Using the same library all the images were then transformed to three formats: png, bmp, jpg (fig. 1). These images were then used for further calculations measuring their size and quality. The quality was measured using Blind/Referenceless Image Spatial Quality Evaluator (BRISQUE) score. Lower score means the image quality was higher.

|  |  |  |
| --- | --- | --- |
|  |  |  |
| a) | b) | c) |

Figure 1. Images used in experiments: a) original, b) grayscale, c) modified

The results of the experiments can be seen in Tables 1, 2, 3 and 4.

Table 1. Colored image sizes

| **Experiment no.** | **JPG size (B)** | **PNG size (B)** | **BMP size (B)** |
| --- | --- | --- | --- |
| 1 | 57192 | 329880 | 921654 |
| 2 | 57594 | 329110 | 921654 |
| 3 | 56700 | 327526 | 921654 |
| 4 | 56267 | 325524 | 921654 |
| 5 | 58533 | 332082 | 921654 |
| **Average:** | 57257.2 | 328824.4 | 921654 |
| **Standard deviation:** | 871.251801 | 2469.124298 | 0 |

Table 2. Grayscale image sizes

| **Experiment no.** | **JPG size (B)** | **PNG size (B)** | **BMP size (B)** |
| --- | --- | --- | --- |
| 1 | 51502 | 265515 | 921654 |
| 2 | 51785 | 262920 | 921654 |
| 3 | 51082 | 265829 | 921654 |
| 4 | 50677 | 265486 | 921654 |
| 5 | 52857 | 276119 | 921654 |
| **Average:** | 51580.6 | 267173.8 | 921654 |
| **Standard deviation:** | 827.986896 | 5136.151059 | 0 |

Table 3. Colored image quality

| **Experiment no.** | **JPG quality** | **PNG quality** | **BMP quality** |
| --- | --- | --- | --- |
| 1 | 47.142194 | 48.409067 | 48.409067 |
| 2 | 47.553464 | 48.142929 | 48.142929 |
| 3 | 47.742309 | 48.692303 | 48.692303 |
| 4 | 46.254396 | 47.929091 | 47.929091 |
| 5 | 44.991242 | 45.576370 | 45.576370 |
| **Average:** | 46.736721 | 47.749952 | 47.749952 |
| **Standard deviation:** | 1.131594 | 1.248343 | 1.248343 |

Table 4. Grayscale image quality

| **Experiment no.** | **JPG quality** | **PNG quality** | **BMP quality** |
| --- | --- | --- | --- |
| 1 | 47.517772 | 47.973215 | 47.973215 |
| 2 | 48.075209 | 47.667695 | 47.667695 |
| 3 | 48.157345 | 47.926944 | 47.926944 |
| 4 | 46.564147 | 47.596421 | 47.596421 |
| 5 | 45.338354 | 44.942543 | 44.942543 |
| **Average:** | 47.130566 | 47.221363 | 47.221363 |
| **Standard deviation:** | 1.186319 | 1.284137 | 1.284137 |

The tables are also visualized as figures as seen in Figure 2, 3, 4 and 5.

Figure 2. Image size dependence on image type

Figure 3. Image size dependence on image type (grayscale)

Figure 4. Image quality dependence on image type

Figure 5. Image quality dependence on image type (grayscale)

# TASK: VIDEO TRANSFORMATION

Similar transformations were performed on the video files (as described in section 1). In this case only sizes were measured for both grayscale and non-grayscale videos. The results are again provided in both table and figure format.

Table 5. Video sizes

| **Experiment no.** | i420 size (B) | DivX size (B) | mp4 size (B) | flv size (B) | xvideo size (B) |
| --- | --- | --- | --- | --- | --- |
| 1 | 22587422 | 139094 | 133065 | 166052 | 139094 |
| 2 | 22587422 | 142392 | 136362 | 170118 | 142392 |
| 3 | 22587422 | 142586 | 136561 | 169845 | 142586 |
| 4 | 22587422 | 147504 | 141474 | 176016 | 147504 |
| 5 | 22587422 | 146200 | 140170 | 174524 | 146200 |
| **Average:** | 22587422 | 143555.2 | 137526.4 | 171311 | 143555.2 |
| **Standard deviation:** | 0 | 3345.993007 | 3345.298238 | 3990.296981 | 3345.993007 |

Table 6. Grayscale video sizes

| **Experiment no.** | **i420 size (B)** | **DivX size (B)** | **mp4 size (B)** | **flv size (B)** | **xvideo size (B)** |
| --- | --- | --- | --- | --- | --- |
| 1 | 22587422 | 121534 | 115502 | 150644 | 121534 |
| 2 | 22587422 | 124786 | 118760 | 154345 | 124786 |
| 3 | 22587422 | 124958 | 118932 | 154303 | 124958 |
| 4 | 22587422 | 129572 | 123545 | 160263 | 129572 |
| 5 | 22587422 | 128626 | 122598 | 158584 | 128626 |
| **Average:** | 22587422 | 125895.2 | 119867.4 | 155627.8 | 125895.2 |
| **Standard deviation:** | 0 | 3244.412921 | 3245.725774 | 3823.059338 | 3244.412921 |

Figure 6. Video size dependence on video type

Figure 7. Video size dependence on video type (grayscale)

# RESULTS AND CONSLUSIONS

There are clear and noticeable differences that can be seen between different image and video formats in terms of quality and size.

## Results

1. Lowest size image format is jpg with mean size of 51580.6 B.

2. The highest quality image format is jpg with mean quality of 46.736721 BRISQUE score.

3. Grayscale images follow the same pattern with slightly different values. The above statements still hold true for grayscale images.

4. Lowest size video format is mp4 with mean size of 137526.4 B.

5. Grayscale videos follow the same pattern with slightly different values. The above statements hold true for grayscale videos.

## Conclusions

1. With more compute it would be interesting to calculate BRISQUE scores for videos too.
2. Best format for images (at least non-transparent ones) is jpg. The best format for videos is mp4.
3. Calculating referenced quality scores could be interesting to see how much of a quantitative loss in quality we get with image transformations to different formats.
4. OpenCV Python hooks seem like an afterthought. A more integrated library should be used in the future (or OpenCV used natively in C).

# REFERENCES

|  |  |
| --- | --- |
| [1] | brisque (n.d.). Rehan Guha. Retrieved from https://pypi.org/project/brisque/ |
| [2] | opencv-python (n.d.) OpenCV Team. Retrieved from https://pypi.org/project/opencv-python/ |