VYTAUTAS MAGNUS UNIVERSITY
FACULTY OF INFORMATICS

Paulius Lapienis

COMPUTER SYSTEMS ADMINISTRATION
LAB WORK NO. 1

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CONTENT

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

1 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.

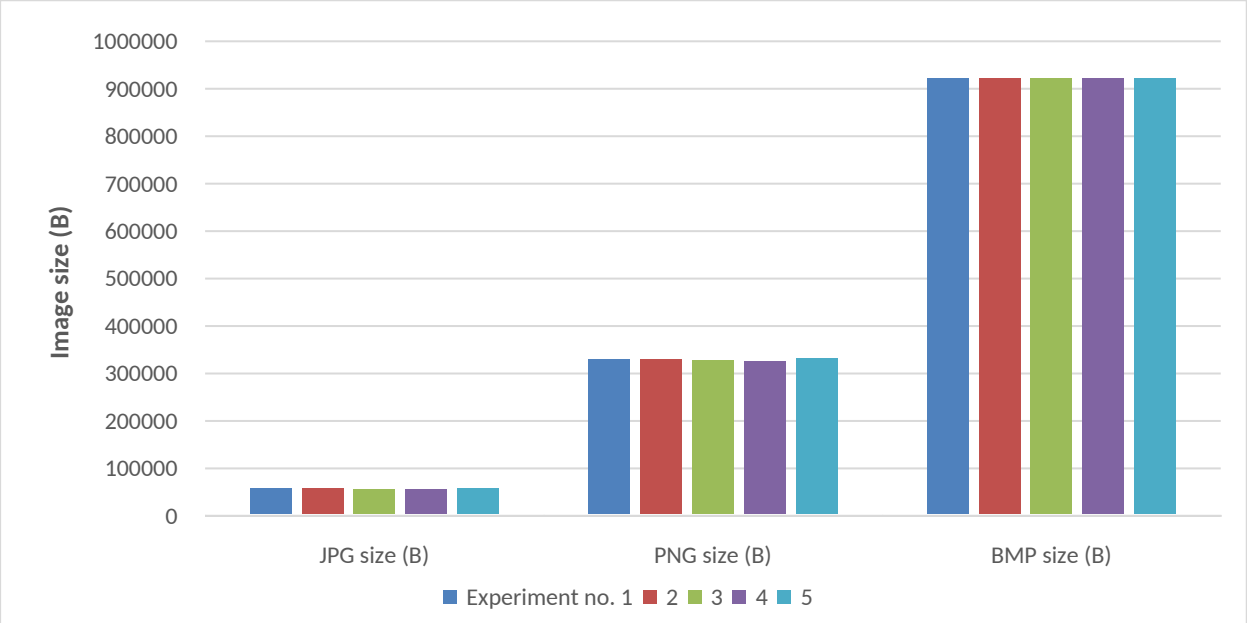

Figure 2. Image size dependence on image type

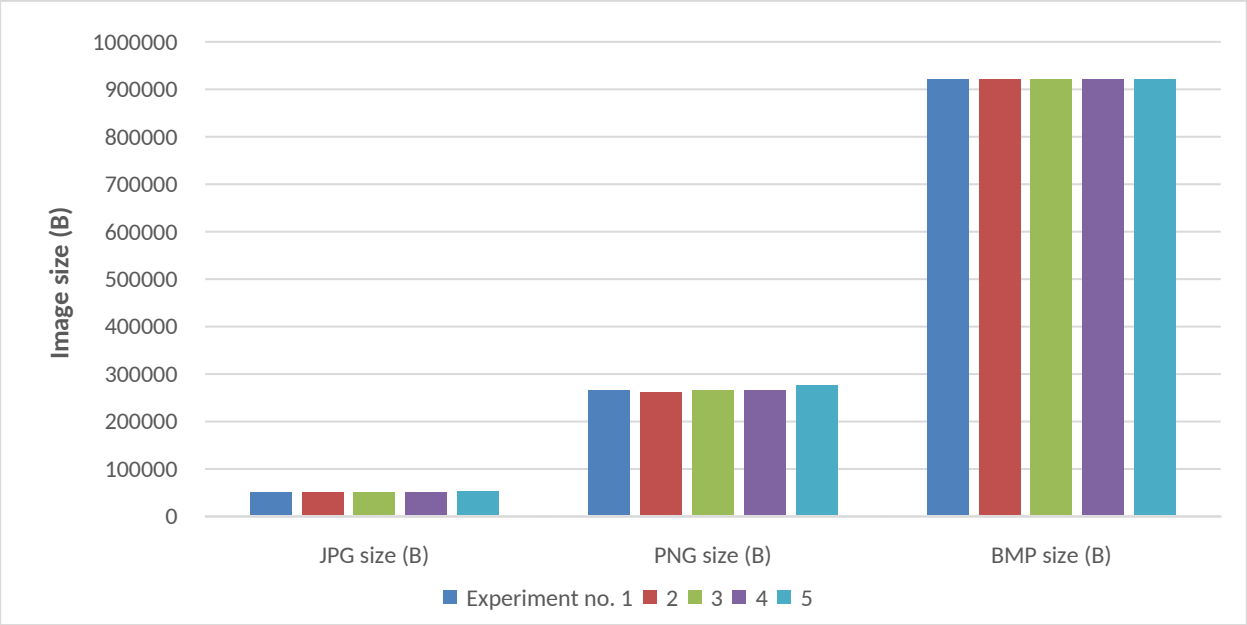

Figure 3. Image size dependence on image type (grayscale)

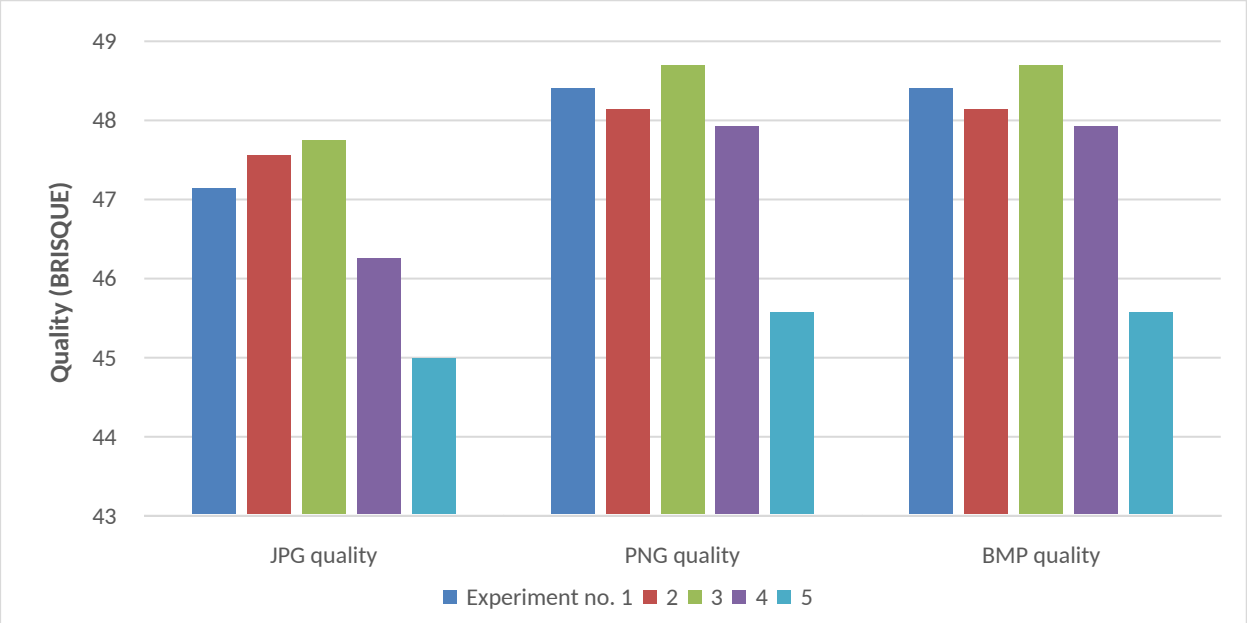

Figure 4. Image quality dependence on image type

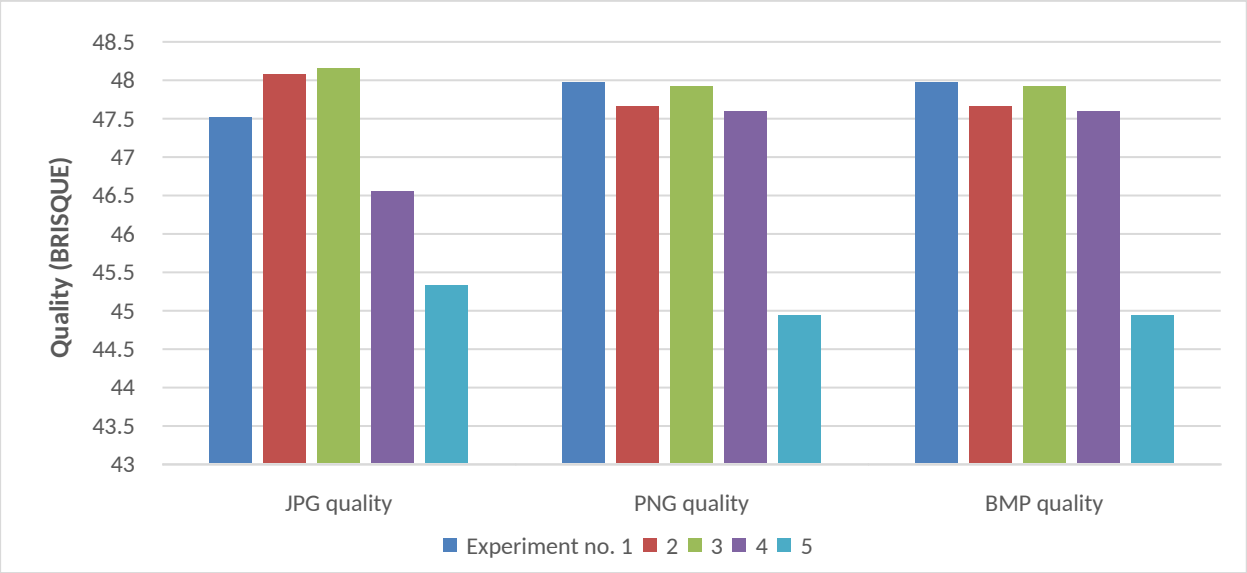

Figure 5. Image quality dependence on image type (grayscale)

2 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. All the videos were taken with 20 FPS. 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

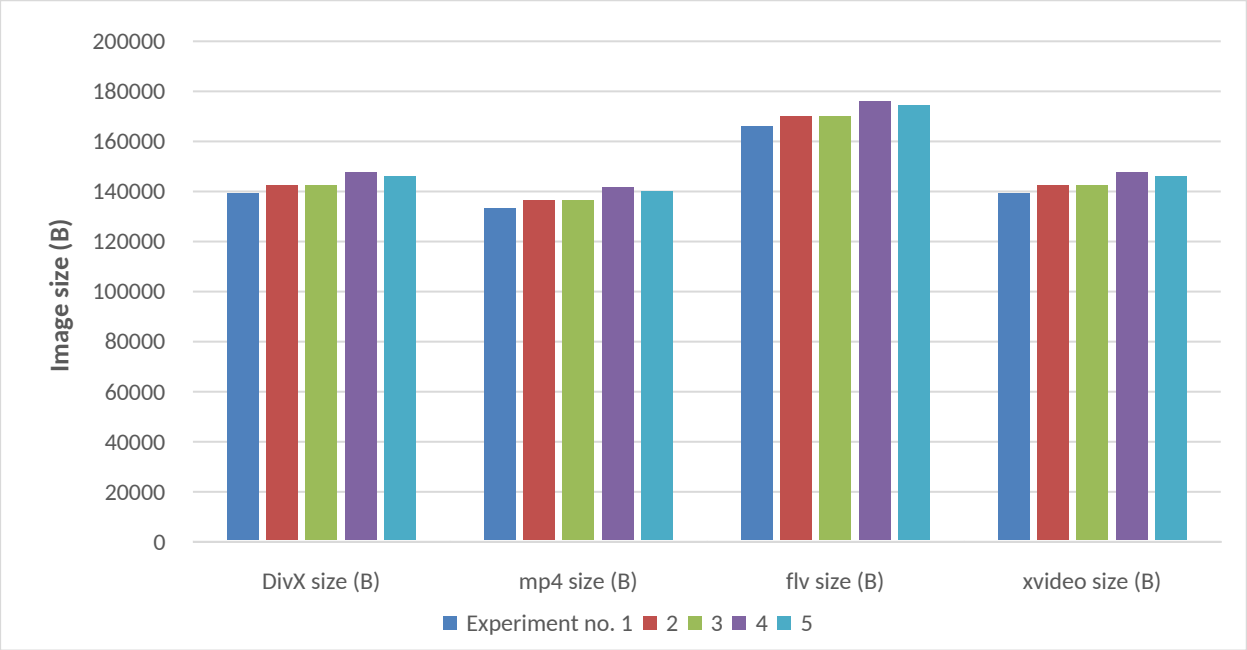

Figure 6. Video size dependence on video type

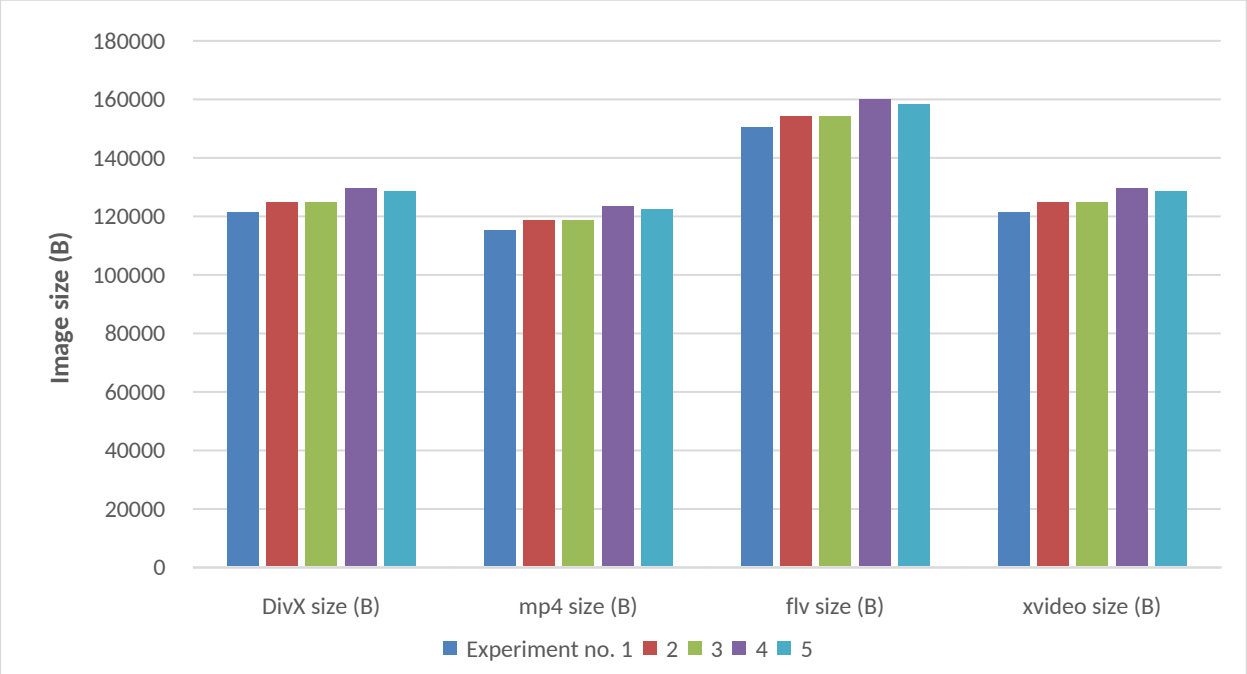

Figure 7. Video size dependence on video type (grayscale)

3 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.

3.1 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.

3.2 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).

4 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/