

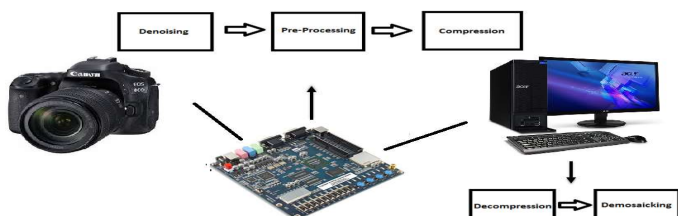
Lossless compression of RAW image data on the FPGA

Arno Libert

Master of Electronics and ICT Engineering Technology

Issue: Multi-camera systems generate large amounts of video data. One central processing system calculates all data. Too much data will be the bottleneck for the processing system computational resources. All data is crucial for calculations.

Research Question: How can incoming data be compressed without loss of data in an efficient manner?



Method: Literary study and comparison of various compression methods. The research is the basis for design choices made. The following problems must be solved:

1. Camera and electronic noise will cause a decrease in compression
2. An efficient, easy to implement compression method must be chosen.
3. An efficient, easy to implement data preparation method must be chosen suitable for the compression method.

Goals: The development and implementation of a lossless video compression method on FPGA. The method must have the following specifications :

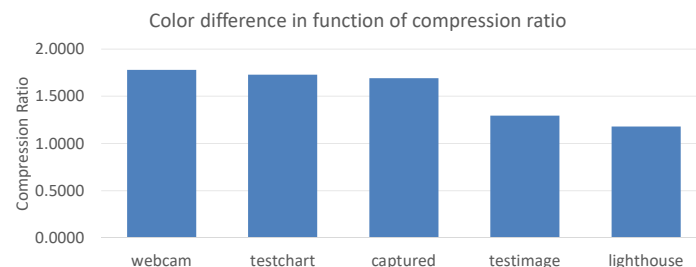
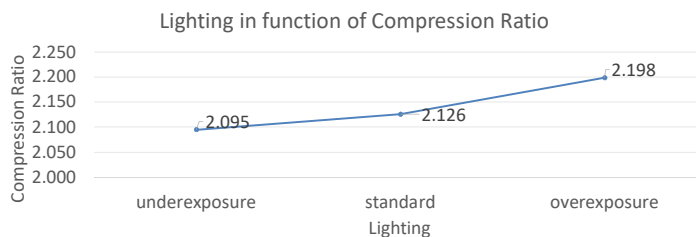
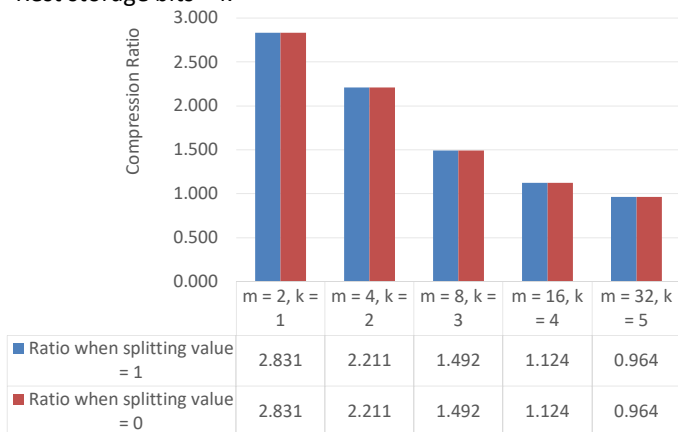
1. Lossless compression
2. Speed > 40 Mb/s
3. Compression ratio $(= \frac{\text{Original size}}{\text{Compressed size}})$ of 40%
4. Easy to implement on hardware

Design choices: Based on the problems stated and the literary research the following design choices are made:

problem	solution
Noise	Dark pixel calibration
Data preparation	Gap method
Compression	Rice encoding

Results: A lossless compression method has been achieved with a faster than 44 Mb/s. The compression ratio is positively affected by an increase in lighting and a decrease in features in the images. The best results in compression are made when the Rice encoding is set to divide by 2 and the remainder stored in 1 bits. The encoding is not affected by the choice between high and low but will affect the power consumption of the hardware.

Divider = m Encoding Method in function of Compression Ratio
Rest storage bits = k



Conclusion: The compression method reaches expectations. Raw data compression can be used for commercial use and increase image quality. In future works other compression methods and data preparation methods can be studied.

Supervisors / Cosupervisors: Prof. Dr. Ir. Luc Claesen
Ing. Wout Swinkels