

# IIT Mandi

## Undergraduate Internship Report

Student's Name: Samyuktha Nelakantam

Title of the Project: Image Quality Analysis

Commencement Date: 06 Jun 2023

Completion Date: 22 Dec 2023

Name of Company/Organisation: Qualcomm India Private Limited.

## IQ Analysis and Tool

IQ analysis serves as a guide for quantifying the image quality in terms of objective and subjective terms and it also serves as base for improving the image processing algorithms catering to the upcoming multimedia applications.

During the internship period, the task is to evaluate the E2E image quality following certain image processing steps. As part of IQ evaluation, we used two objective metrics, viz., PSNR and SSIM and subjectively by detailed visual inspection.

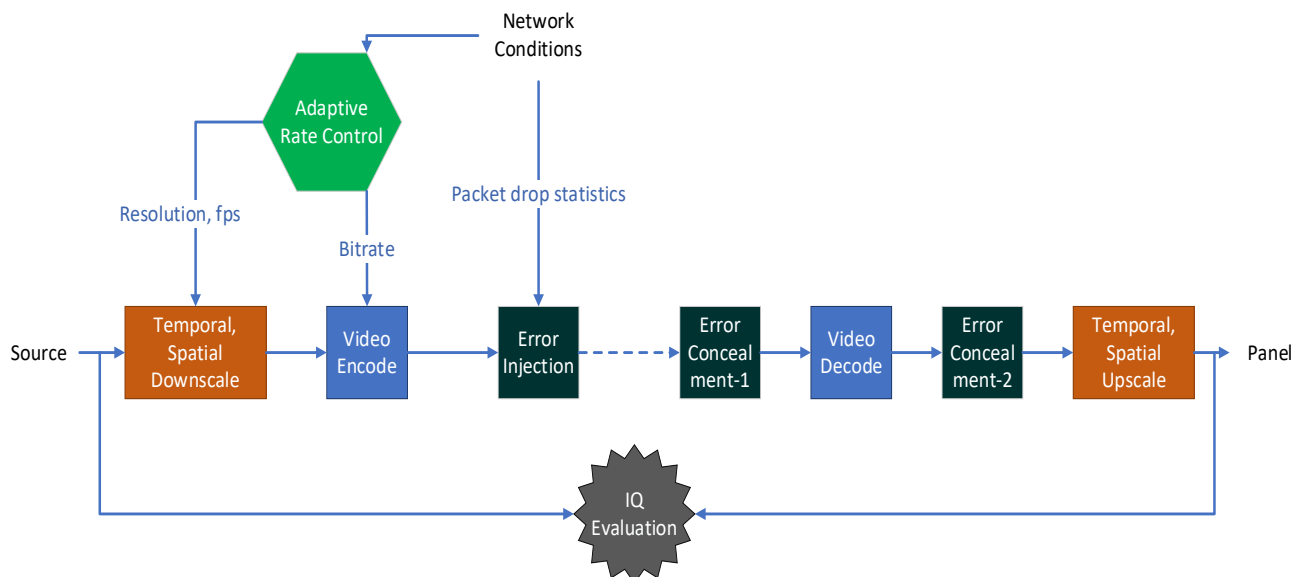


Image processing steps to find the best configuration available to get best image quality:

- 1.) Input image is downscaled to some lower resolution. Downscaling is done for data reduction so that it is more manageable for storage and processing.
- 2.) The downscaled image is encoded using image encoder to some bitrate supported for wireless transmission and reception.
- 3.) The downscaled image's encoded bitstream is decoded post reception.
- 4.) The decoded image is upscaled back to original input resolution, upscaling is done by interpolating existing pixels to create new ones.
- 5.) The original image and final upscaled image are compared for IQ analysis.

Note that downscaling and upscaling are optional steps and if the wireless channel has high bitrate then they are omitted to ensure higher image quality.

This stepwise process above is designed in SW and automated as a tool for end user convenience.

Specific c-model executables were used for upscaling, downscaling and image encoding, decoding.

Encoder bitrate is also selected to match the network bitrate requirements.

### **Challenges faced:**

The challenge faced in this flow is how the image quality is affected due to entire image processing pipeline above and how to find the optimal configuration of the pipeline for best image quality.

Choosing the optimum down-scalers, up-scalers and encoders which are specific to industry are to be decided.

These tools are integrated in python script to get IQ for multiple input images, with multiple resolutions and bits per pixels.

This python script is converted into an exe tool for the user to give command line parameters and get the final scores without running multiple commands in each step.

Another challenge is due to the network error there will be packet drop and error injection, for which we need to perform the error concealment (EC). In EC, the encoded image bitstream is read as slices, each slice has a specific size with the header. The slices received in error are replaced with respective slices of different frames. Due to this strategy, the decoding of frame is done correctly even in case of network error and finally IQ analysis is done.

Another case of error concealment is post the decoding, where we conceal the error in decoded image using previous frame received.

**Conclusion:**

The outcome of the IQ study enabled us to determine the ideal configuration for the different wireless channel capacities so that we could maximize the IQ for that channel capacity.

Student's Signature: \_\_\_\_\_ Date: \_\_\_\_\_

I certify that Samyuktha Nelakantam has satisfactorily completed the Internship and worked on the project referred to above. Her conduct as an intern has been up to the mark in all respects.

\_\_\_\_\_  
(Signature of Supervisor)

Date: 22<sup>nd</sup> December 2023

Supervisor's Name: Yogesh Gupta  
Designation: Senior Staff Engineer / Manager  
Company/Organisation: Qualcomm India Private Limited.