1. CUHK-CQRC: A LARGE-SCALE COLOR QR CODE DATASET

We propose a challenging color QR code dataset, CUHK-CQRC\(^1\), in this paper. CUHK-CQRC consists of 1,506 photos and 3,884 camera previews (video frames) of high-density 3-layer color QR codes captured by different phone models under different lighting conditions. Fig. 1 presents some samples of CUHK-CQRC. Different from [1], we also include previews in our dataset because of the two reasons. Firstly, photos are different from previews. When users take a photo using the on-board camera of a mobile phone, many embedded systems implicitly process (e.g., lightweight deblurring and color correction) the output image in order to make it more attractive in appearance, while preview will not go through this process. Secondly, compared with capturing photos, it is much faster and more cost-effective for a cell-phone camera to generate previews, and hence most mobile applications use camera previews as the input of the decoder.

We implement the color QR code generator based on an open-source barcode processing library, ZXing, and we also deploy the HiQ generator on-line at https://authpaper.net/. For fair comparison between HiQ-C and PCCC in which the color QR code is inherently 3-layer, so we generate 5 high-capacity 3-layer color QR codes with different data capacities (excluding redundancies from error correction mechanism) which are 2787 bytes, 3819 bytes, 5196 bytes, 6909 bytes and 8859 bytes (maximum for a 3-layer color QR code). In order to test the limit of each approach, all color QR codes are embedded with low level of error correction in each layer. By using a common color printer (Ricoh Aficio MP C5501A), we print each generated color QR code on ordinary white paper substrate in different printout sizes, 30 mm, 40 mm, 50 mm and 60 mm (for simplicity, we use the length of one side of the square to represent the printout size), and two different printout resolutions, 600dpi and 1200dpi. To simulate the normal scanning scenario, the samples are captured by different users under several typical lighting conditions: indoor, outdoor (under different types of weather and time duration of a day), fluorescent, incandescent, and shadowed (both uniform and nonuniform cases are considered). Moreover, we capture the images using eight types of popular smartphones see Table 1 for details.

2. ADDITIONAL EXPERIMENTAL RESULTS

To provide better understanding of our method, we present detailed experimental results of the usability study (Sec. 5 of the main paper), see Fig. 2. For each printed HiQ code, we collect the scanning time (in seconds) of 30 successful trials (i.e., trials where the HiQ code is successfully decoded) using

---

\(^1\)https://authpaper.net/colorDatabase.html
Fig. 2. Scanning performance of HiQ across various content sizes, printout sizes and error correction levels.

iPhone 6 Plus. We use the 90th percentile, 10th percentile and median to represent the upper bound, lower bound of the scanning time and the overall performance.

3. REFERENCES