TOWARDS NEXT GENERATION BARCODE SCANNING

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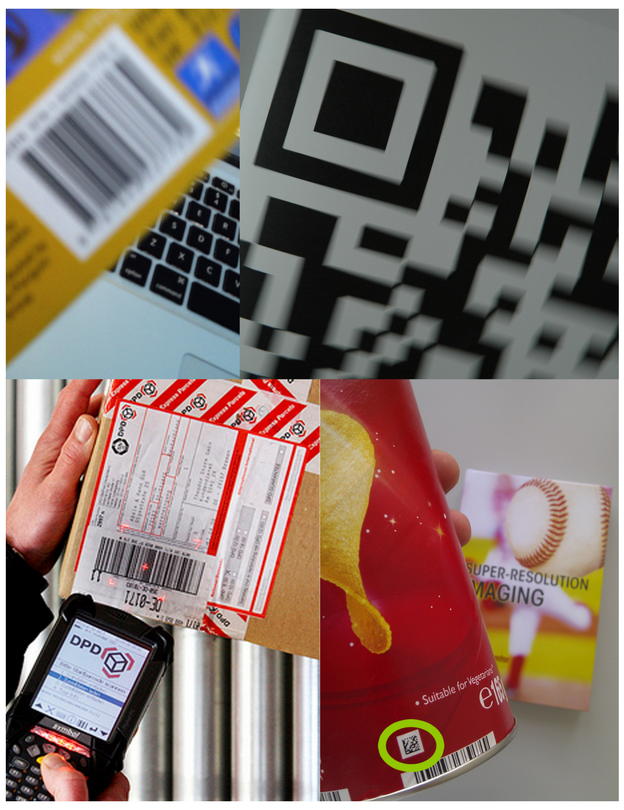
Abstract

Smartphones and tablets are increasingly used to scan visual codes that act as physical hyperlinks to digital information [1]. Compared with the outstanding performance of enterprise laser scanners, smartphone cameras often suffer from defocus and motion blur. In this project, we propose to turn every smartphone into an enterprise-grade barcode scanner by adapting the latest research results in photograph restoration to the very specific properties of barcode images.

Challenges

Current smartphone-based scanning solutions do not meet enterprise requirements in speed and reliability. In particular, their shortcomings include:

- out-of-focus blur
- motion/shake blur
- no localization cue from laser
- limited image resolution



References

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Photos were taken in the restaurant FoodLab.

Motivation – Why use **smartphones/tablets** as **barcode scanners**?

Enterprise barcode scanners are expensive devices and therefore only selected people (e.g., airport baggage controllers) are using them. Our goal is to improve business processes by providing a ubiquitous barcode scanning solution for each employee in the value chain.

Smartphone-based visual code scanning is attractive for many reasons:

- smartphones are ubiquitous, tablets are getting popular
- most smartphones have (autofocus) cameras
- outstanding computing and sensing capabilities
- intuitive user interface
- easy application development and business process integration
- new enterprise use cases (e.g., tablet as point of sale for small businesses)

Related work – Barcode deblurring differs from photograph deblurring

Post-shoot photograph deblurring is an active research area, for a recent survey please refer to [2]. All previous work makes assumptions such as special hardware, uniform point spread function (PSF), static and/or planar scene, or restricted types of motion that may not be true in barcode scanning. These algorithms are also tuned for natural scenes and often involve sophisticated optimization methods with excessive amount of computations that restrict real-time operation.

Two visual codes deblurred by [3] and [5] together with the estimated (false) PSFs.
Current methods are optimized for natural scenes and often fail with artificial image content.
Their results are not recognized by a common decoder [6].

Approach – Towards real-time barcode deblurring

Recent methods such as [4] and [5] recover the PSF by inspecting blurry edges in the image. This approach is especially appealing since in case of barcode scanning:

- the original scene is often **planar** and contains **sharp edges**
- intra-frame and inter-frame **motions** are **small**
- **corners** in 2D codes are more **robust to blur** and are easier to **track** over multiple frames
- smartphones are equipped with **inertial sensors** that can help the PSF estimation
- the problem is suitable for **parallel processing** (on mobile GPU)
- codes do **not need** to be perfectly **sharp** for decoding

Our contribution will be a new algorithm which exploits these distinct properties with the goal of real-time decoding instead of visually pleasing deblurring.

Preliminary results – Code localization

We have extended the 1D code localization method of Gallo et al. [7] for blurry codes and 2D codes. Our algorithm takes not only gradient distribution maps but also the Harris corner measure into account because the cornerness is more distinctive under blur.

The extracted code area is assumed to have uniform blur thereby speeding up the subsequent steps.