Lab 5

AR Markers

This lecture is part of the RACECAR-MN introductory robotics course.
You can visit the course webpage at mitll-racecar-mn.readthedocs.io.

Objectives

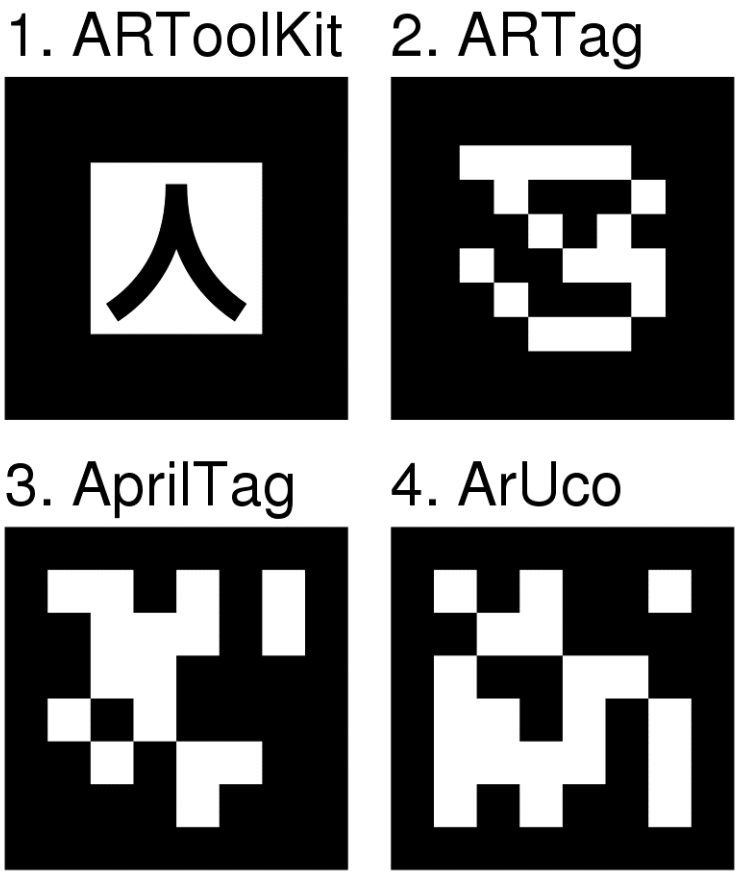
Main Objective: Combine your previous lab solutions to complete the time trial racecourse

Learning Objectives

- Identify the location, orientation, and id of AR markers in a color image
- Make decisions based on information provided by AR markers

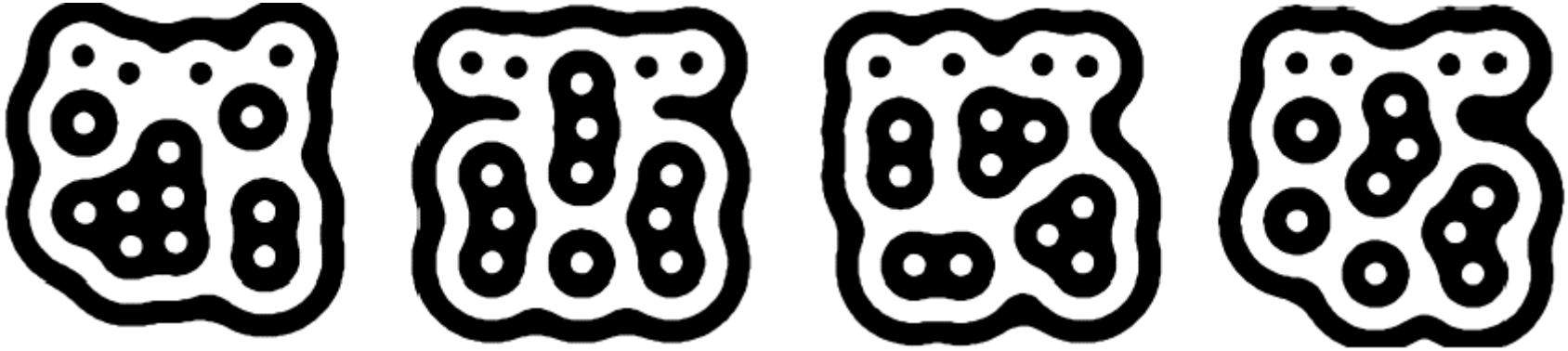
AR Markers

- **Fiducial markers** used for augmented reality
- Common characteristics:
  - **high contrast**
  - **bi-tonal**
  - **square**
  - **bordered**



AR Markers - Outliers

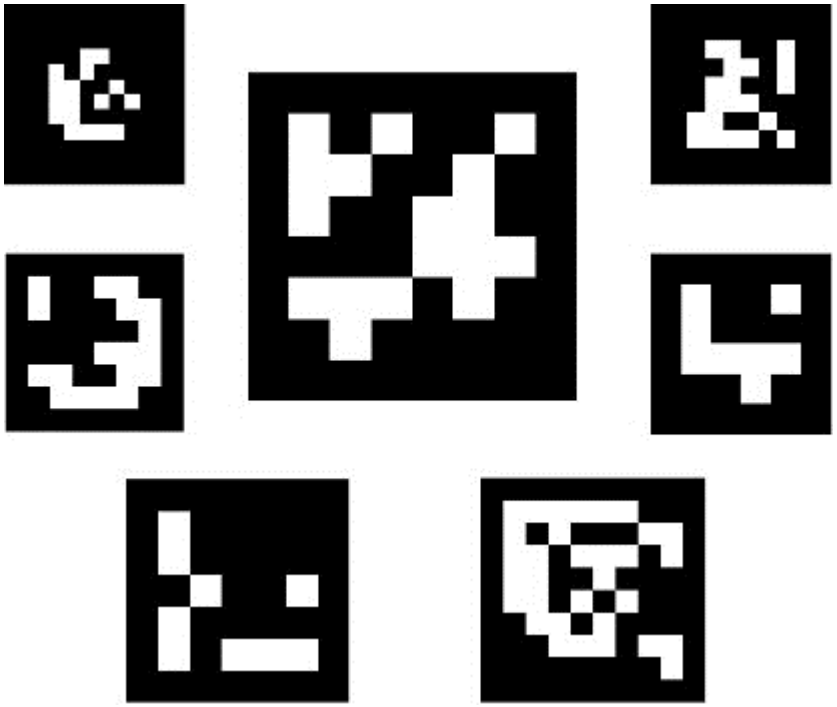
- ReacTIVision



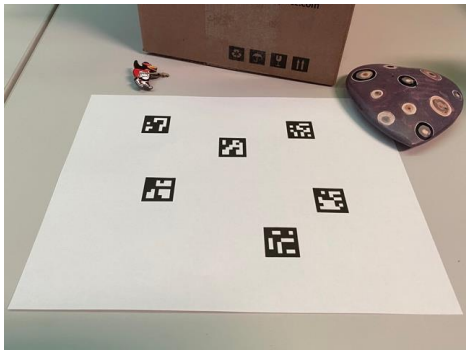
- ARToolKit

ArUco OpenCV

- Border of black with a binary encoding in the center
- Checks orientation
- Marker id is not determined by binary coding in the marker but the index in a defined dictionary



ArUco OpenCV



Original image

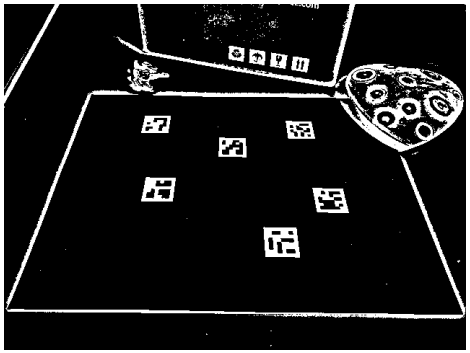
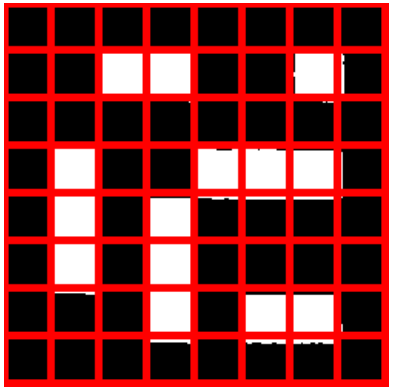


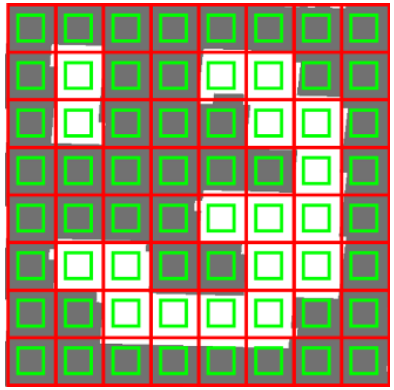
Image with threshold

Marker candidate

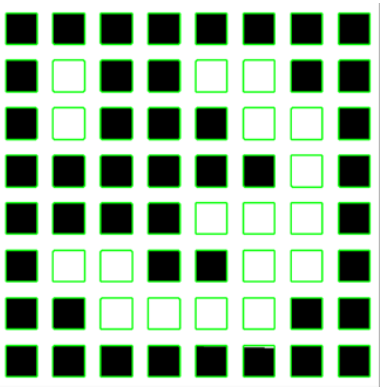
Removed perspective



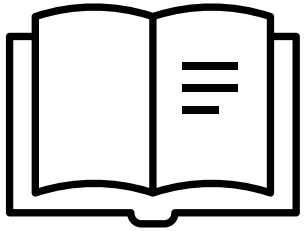
Applied grid



Cell margin

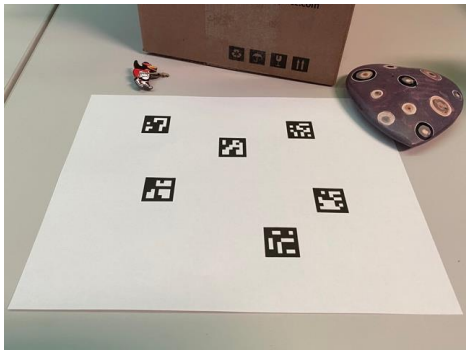


Final sampling margin



Dictionary lookup

ArUco OpenCV



Original image

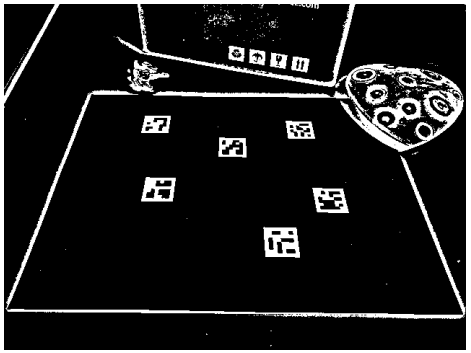


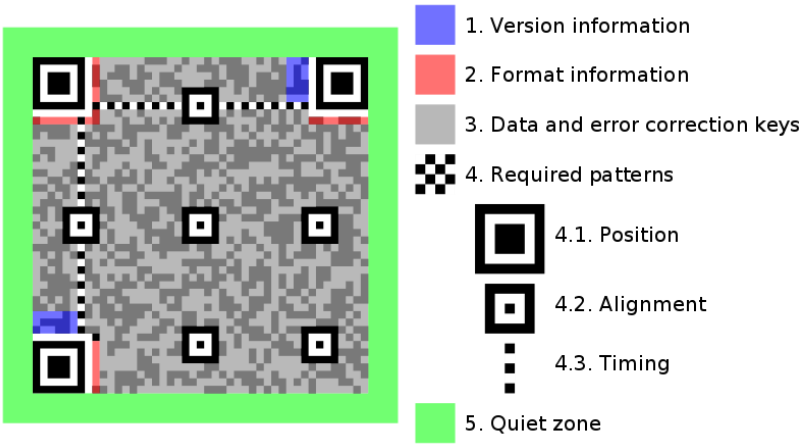
Image with threshold

Marker candidate

Removed perspective

Information Gained

- **ArUco Markers** encode
  - Corner location
  - Marker id (dictionary index)
- **QR Codes** encode
  - Binary data



QR vs AR

Group activity

- QR codes have all the common characteristics of AR markers but are commonly used to direct to a URL
- What major differences are there between QR codes and AR markers like ArUco markers?
- Why would a QR code be a bad AR marker?