Practical Camera Calibration for Large Rooms

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Introduction
- RoboCup: The All Botz team
- Camera Calibration
- Tsai Camera Calibration
- Sort matching points
- Evaluation
- Conclusion

The Problem
- Can’t control what you can’t see
- But also, you must know an objects
  - Position
  - Orientation
  - Velocity
- Camera calibration:
  - Map Image Coordinates to Real World Coordinat

Our Environment
- Maximum Ceiling (2.5m)
- View with our camera
The Pin Hole Camera Model
- Point Aperture
- Small lens width
- 11 Parameters (6External, 5 Internal)

Tsai Camera Calibration
- Camera Calibration is a well known problem in computer vision
- Many different methods have been proposed for the pin hole camera model
- Roger Tsai:
  - LMS approximation of external parameters.
  - Non-linear approximation of radial lens distortion
  - Numerically robust
- Popular, well understood, free implementation

Matching Points
- Pixel and real world coordinates of at least 12 points
- Rule of thumb: > 20 points
- Matching points
  - Special features in the environment
  - Manually create the points (error prone)
  - Calibration pattern
- Requirements:
  - Accurate, fast, portable, cheap, flexible
  - Duvet cover with back removed

Calibration Image
- Calibration Image after segmentation
- Threshold and remove single pixels (Noise)
- Missing Squares
- Incomplete Squares
- Rotation
Sort Matching Points

- Select Features of Squares (Corners)
- Center moves under perspective distortion

Evaluation

- Evaluated number accuracy vs. number of matching points.
- In general, accuracy increases with the number of correct points
- But: one false match can break the model
- Small set of good points

Conclusion

- Described a practical, fast, accurate, cheap method for calibrating cameras in large rooms
- Evaluated the influence of the number of matching points
- Accuracy is sufficient for our problem (< 1cm)