**Motivation**

Problems of most existing toolboxes for camera calibration:
- No detailed guidelines for taking images
- Not clear indicator of calibration quality
- ☹️ Unfriendly to inexperienced users

**Goal:** Guide users to acquire **optimal poses** for calibration

**Calculation of Optimal Next Pose**

\[
I = \begin{pmatrix}
A_1 & B_1 & 0 & \cdots & 0 & 0 \\
A_2 & B_2 & 1 & \cdots & 0 & 0 \\
\vdots & \vdots & \vdots & \ddots & \vdots & \vdots \\
A_n & B_n & 0 & \cdots & 0 & 1
\end{pmatrix}
\Rightarrow
\begin{pmatrix}
\wtilde{g} & \wtilde{w} \\
\wtilde{y} & \wtilde{v}
\end{pmatrix} = (J^T J)^{-1}
\]

Upper-left \(k \times k\) sub-matrix of \((J^T J)^{-1}\) is the covariance matrix of \(\Theta\) [1]

**Corner Uncertainty**

Problem: **Extreme camera poses** challenge corner detectors.

Solution: Consider corner uncertainty when computing next pose

- Estimate the expected autocorrelation matrices \(\Sigma_m\) of each corner point
- Express \(\Sigma_m\) as a function of opening angle and blur
- Incorporate into the calculation of

\[
J^T J = \begin{pmatrix}
\Sigma_1 & \cdots & \Sigma_m
\end{pmatrix}
\]

**Comparison of Captured Images**

- Freely-taken images
- Wizard-guided images

**Synthetic Evaluation**

Ground-truth: \(f = 800, (u, v) = (320, 240), k_1 = 0.5, k_2 = 1\)

**Real-World Evaluation**

**Pose Estimation**

**Structure from Motion Test**