Introduction

- **Definition (Fast Moving Object, FMO):** object is fast moving if its trajectory projected on the image plane is larger than its size.
- **Image formation model:** $I = \{1 - P \cdot M B + P \cdot P\}$ → convolution
- **Image difference:** $\Delta = I - B = P \cdot F - (P \cdot M)B$
- **Multiple FMOs:** $\Delta = \sum P^i \cdot F^i - (\sum P^i \cdot M^i)B$
- **Goal:**

Analysis of Standard Tracking Sets: VOT [1], OTB [2], ALOV [3]

FMO Annotated Public Dataset [4] and Examples

FMO Localization Algorithms

- **Detection algorithm**
  1. Input images → background (estimating by median)
  2. $\Delta_s = |\hat{I} - B| > \theta$ (threshold set adaptively)
  3. Strawley connected components
  4. Not a lateral motion (checked by KLT tracker)
  5. Not a shadow → FMOs (check of gradient fields)

Full FMO localization: Detection, Re-detection and Tracking

- **Full FMO localization:**
  - Detector
  - Re-detector
  - Tracker

Applications

- **Temporal super-resolution**
- **Object counting**
- **Projected translational velocity vs radar**

Evaluation

- **Criteria:** precision, recall, F-score
- **SOTA trackers:** perform poorly

Example detections:

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