An Accurate Localization Scheme for Mobile Robots Using Optical Flow in Dynamic Environments

Introduce

in dynamic scenarios, cannot localize the robot very accurately.

there are mainly two kinds of method:

- information fusion different sensors
- use rgbd to outlier

But low cost, easy calibration monocular is more popular sensor for VSLAM.

So the author proposed a method use optical flow for mono to distinguish dynamic fpoint.

Framework

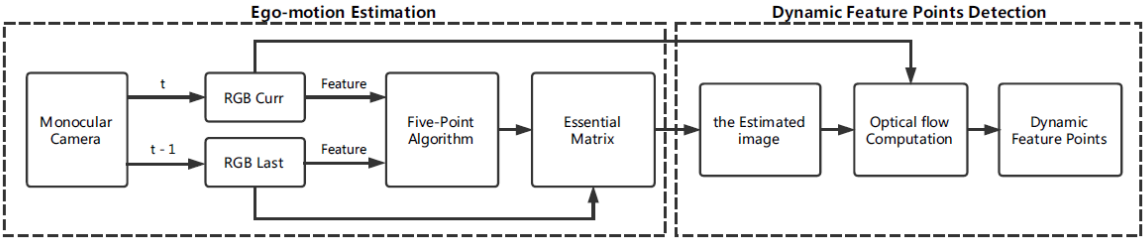
$$\arg\min_{a_j,\ b_i} \sum_{i=1}^{n}\sum_{j=1}^{m} w_{ij}(X_{ij} - Q(a_j, b_i))^2,$$

$$\arg\min_{a_j,\ b_i} \sum_{i=1}^{n}\sum_{j=1}^{m} w_{ij}(X_{ij} + \beta_{ij}V_{ij} - Q(a_j, b_i))^2,$$

if fpoint is dynamic, β set as 1

vector V denote changes of the location, but not accurate or has no prior

This is the author's pipeline



- use 5-point compute E by current and last frame to get pose
- multiply last image with pose to get the estimated image
- use LK flow between current and estimate image

fpoint is orb and integrate with orb-slam

$$\begin{cases} d > \tau, \text{ if } f_i \in F_{dynamic}, \\ d < \tau, \text{ if } f_i \in F_{static}, \end{cases}$$

select static fpoint for further estimate

this is the result:

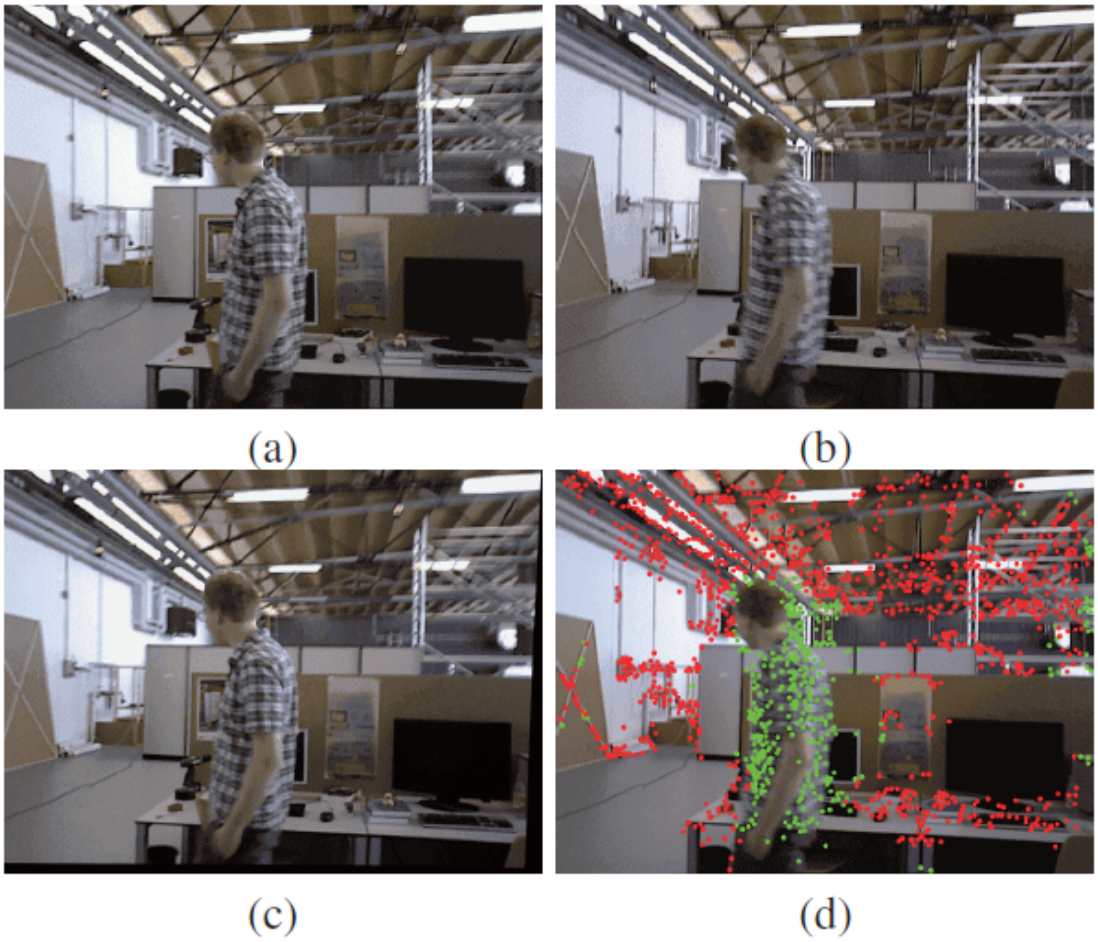


Fig. 2: An experimental result of our method. (a)-(c) represent the last RGB image, the current RGB image and the estimated image. (d) is the result of our method. Red points are static and green points are dynamic.

Result

verify on the TUM RGB-D dataset compared the raw orb-slam method

and τ in Optical flow-based Detection to 2 empirically

the result in desk, sitting and walking scenarios.

ATE without / with this method in orb-slam