

Absolute scale velocity determination combining visual and inertial measurements for micro aerial vehicles

Jacques Kaiser, Agostino Martinelli

Team Chroma, INRIA



July the 3rd, 2015

State estimation for drones



State estimation for drones



State estimation for drones



State estimation for drones



State estimation for drones



Localization in various environments

State estimation for drones



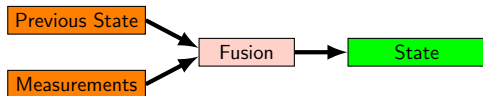
Localization in **various environments**

Reliable sensors:

- ▶ Camera;
- ▶ Inertial Measurement Unit (IMU).

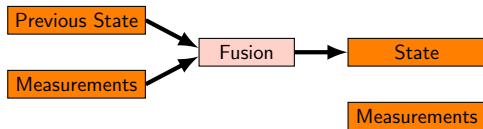
Visual-inertial sensor fusion

Filter based method



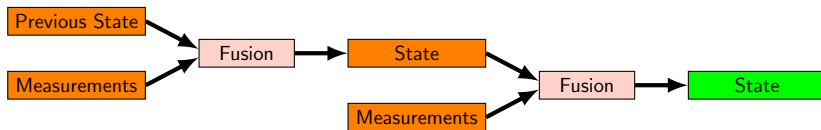
Visual-inertial sensor fusion

Filter based method



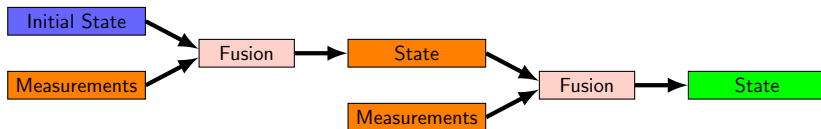
Visual-inertial sensor fusion

Filter based method



Visual-inertial sensor fusion

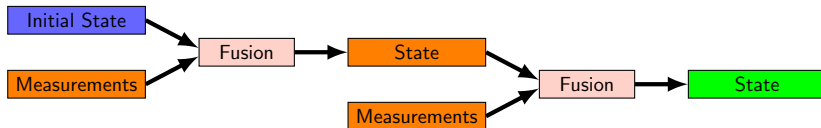
Filter based method



How to recover the **initial state**?

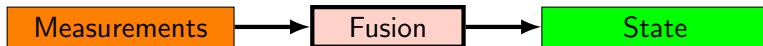
Visual-inertial sensor fusion

Filter based method



How to recover the **initial state**?

We need a **deterministic solution**



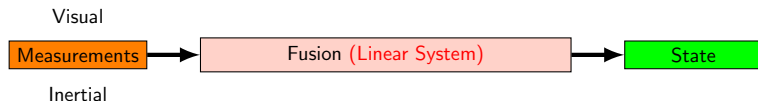
The Closed-Form Solution

Transactions on Robotics (T-RO) 2012
International Journal of Computer Vision (IJCV) 2014

The Closed-Form Solution

Transactions on Robotics (T-RO) 2012
International Journal of Computer Vision (IJCV) 2014

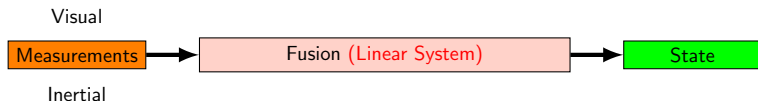
Theory:



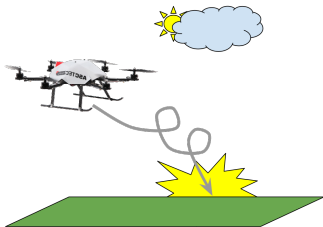
The Closed-Form Solution

Transactions on Robotics (T-RO) 2012
International Journal of Computer Vision (IJCV) 2014

Theory:



Practice:

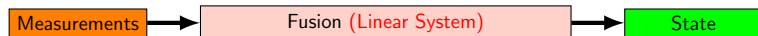


The Closed-Form Solution

Transactions on Robotics (T-RO) 2012
International Journal of Computer Vision (IJCV) 2014

Theory:

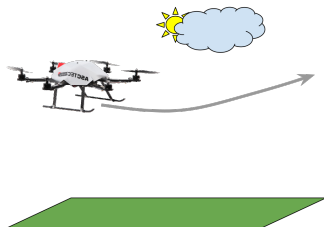
Visual



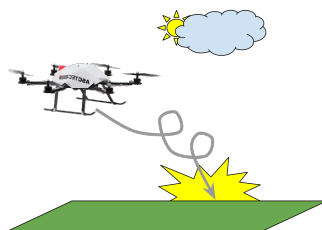
Inertial

Practice:

Accelerometer bias?



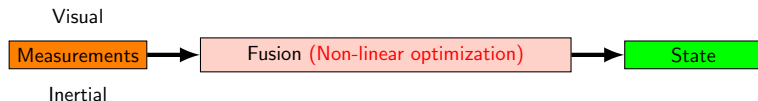
Gyroscope bias?



The Closed-Form Solution

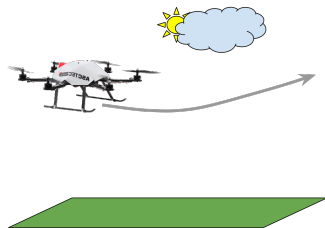
Transactions on Robotics (T-RO) 2012
International Journal of Computer Vision (IJCV) 2014

Theory:



Practice:

Optimization to recover the gyroscope bias





Thank you for your attention,
come visit our poster