Localisation basée-image au LaSTIG

Rencontres Scientifiques ouvertes à l'Université Gustave Eiffel

Marc Pierrot Deseilligny, Ewelina Rupnik

1 Univ. Paris-Est, LASTIG ACTE, IGN, ENSG, F-94160 Saint-Mande, France

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Introduction

Mobile mapping system

Goal: very accurate geolocalisation in urban zones

- Fine camera calibration (internal parameters)
- Introduction of inter-camera rigid constraints

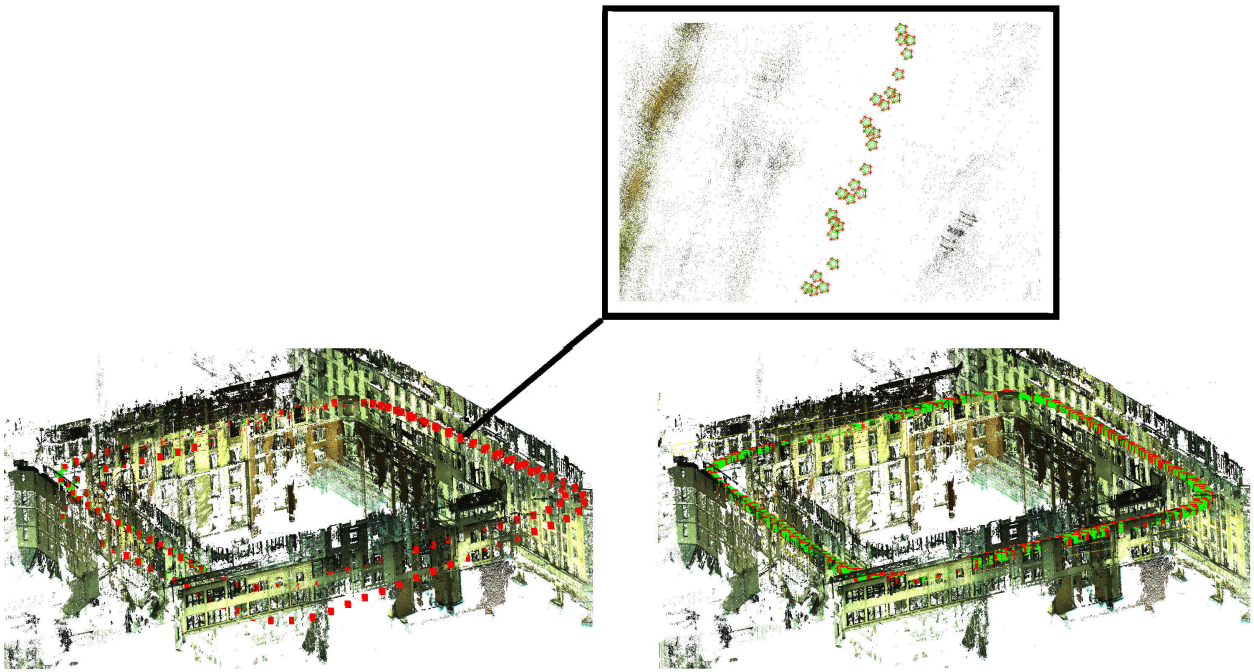

Figure: Left: pose estimation without up-to-date camera calibration; right: pose setimation with self-calibration.

UAV mapping

- Modelling of the rolling shutter effect, [Zhou et al., 2019],
- Thermal effect modelling, [Daakir et al., 2019]
- New tie-points computation, [Truong Giang et al., 2018]
- Lever arm modelling, [Daakir et al., 2017]
- New camera models, [Tournadrea et al., 2015]

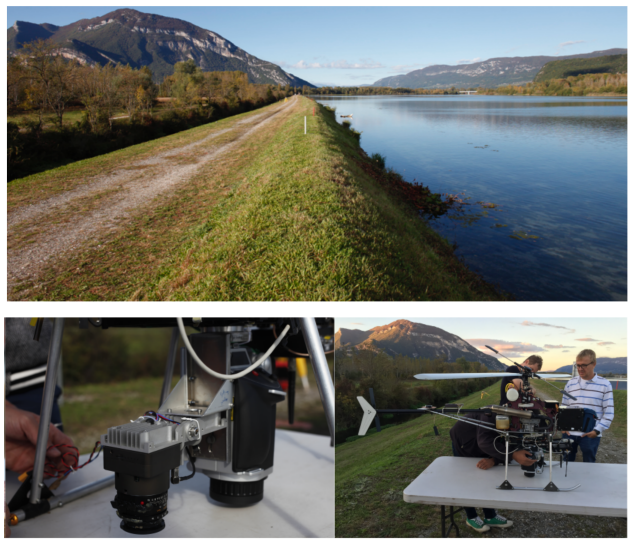

Figure: Top: Dyke "La Palliere", Culoz, France. Bottom: CamLIGHT and a thermal camera mounted on Survey Copter 1B

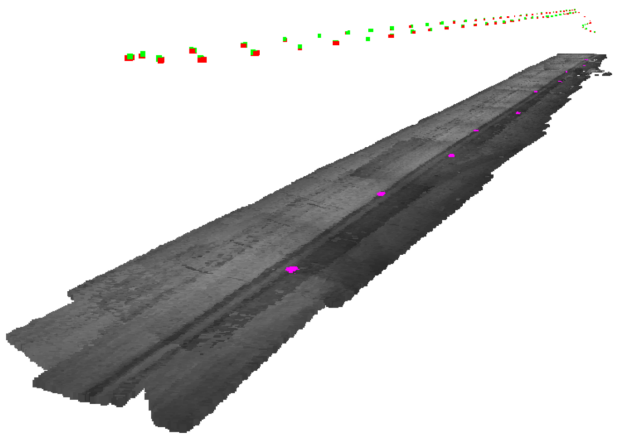

Figure: UAV-survey of the dyke.

Acquisition systems

Mobile mapping system MMS

- 5 fish-eye Ladybug cameras
- 2 front- and backward pointing Pike cameras
- INS, GNSS

Figure: Stereopolis, IGN's mobile mapping system.

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Unmanned aerial vehicles

- CamLIGHT IGN, Loemi
- on-board embedded GNSS receiver (u-blox mono-frequency)

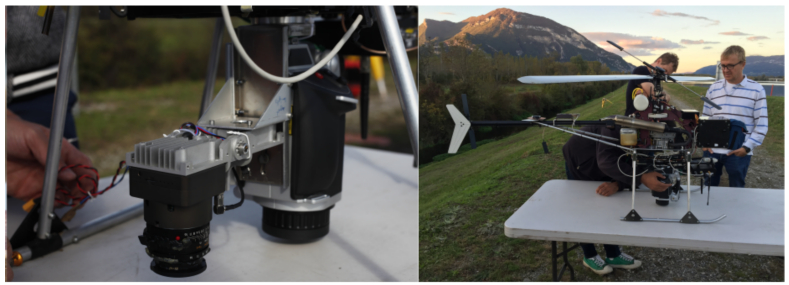

Figure: Left: CamLIGHT and a thermal camera; right: Survey Copter 1B

Software

MicMac

- A complete processing chain:
  - Structure from Motion (SfM),
  - surface reconstruction,
  - ortho-rectification;
- Frame and pushbroom sensors;
- Strong focus on metrology
  (time less of a concern, off-line processing);
- Open-source since 2007[a],
- Users: IGN, IPGP, CNRS MAP, and many individuals (770 forum users)

[a] github.com/micmacIGN/micmac , micmac.esng.eu, forum-micmac.forumprod.com

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Pipeline

Pipeline

1. Feature extraction (e.g. SIFT)
2. Relative SfM
   - hierarchical, adapted to "linear" acquisition, e.g. Stereopolis
   - sequential or global SfM, e.g. UAV
3. Georeferencing using
   - Ground Control Points (GCP) / landmarks,
   - GNSS-measured perspective centers.

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Remark, explicit constraints on:

- rigidity of the camera's relative position, Stereopolis;
- lever-arm, UAV,Stereopolis.

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Lessons learnt / On-going research activities

Lessons learnt

Findings:

- UAV, GNSS + photogrammetry and multi-band
  - 1cm precision with 1GCP
  - 3-4cm w/o GCP
- Mobile mapping
  - pure photogrammetry, 10cm drift every 250m

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Perspectives:

- UAV,
  - 1cm precision w/o GCP
  - corridor mapping (1 band) with low-cost INS
- Mobile mapping
  - GNSS-photogrammetry fusion in non-urban zones (low-cost system)
  - GNSS-photogrammetry-INS in urban zones

On-going research activities

1. Trajectory drifting
   Extracting features between aerial and MMS images
   1 PhD thesis
2. Inclusion of INS constraint in the pose estimation pipeline
   Julien l'Harridon, engineer
3. GNSS processing in presence of GNSS masques
   Yann Meneroux, chargé de recherche
4. Efficient algorithms for pose estimation in large dataset
   Ewelina Rupnik, chargée de recherche
5. Inspecteur de travaux finis ;)
   Marc Pierrot Deseilligny, directeur de recherche

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MATIS
METHODES D'ANALYSE ET DE TRAITEMENT D'IMAGES POUR LA STEREO-RESTITUTION

Merci pour votre attention

Question(s) ?

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