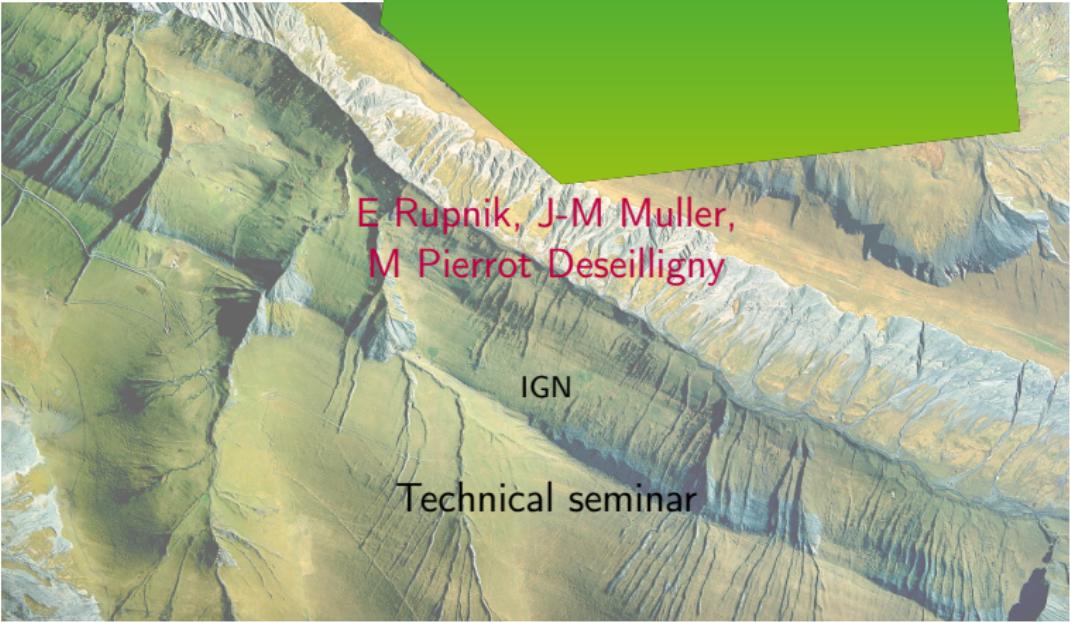




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MicMac – a global overview



A large, semi-transparent green rectangular overlay is positioned in the upper right quadrant of the slide, containing the title text. Below this, the background image shows a detailed aerial or satellite view of a mountainous landscape. The terrain is a mix of green fields, blue lakes, and greyish-blue rocky areas. The word "IGN" is faintly visible in the center of the image.

E Rupnik, J-M Muller,
M Pierrot Deseilligny

IGN

Technical seminar

Introduction

Tie points extraction

Without a priori geometry

With a priori geometry

Reduction algorithms

Image orientation

SfM and structureless BBA

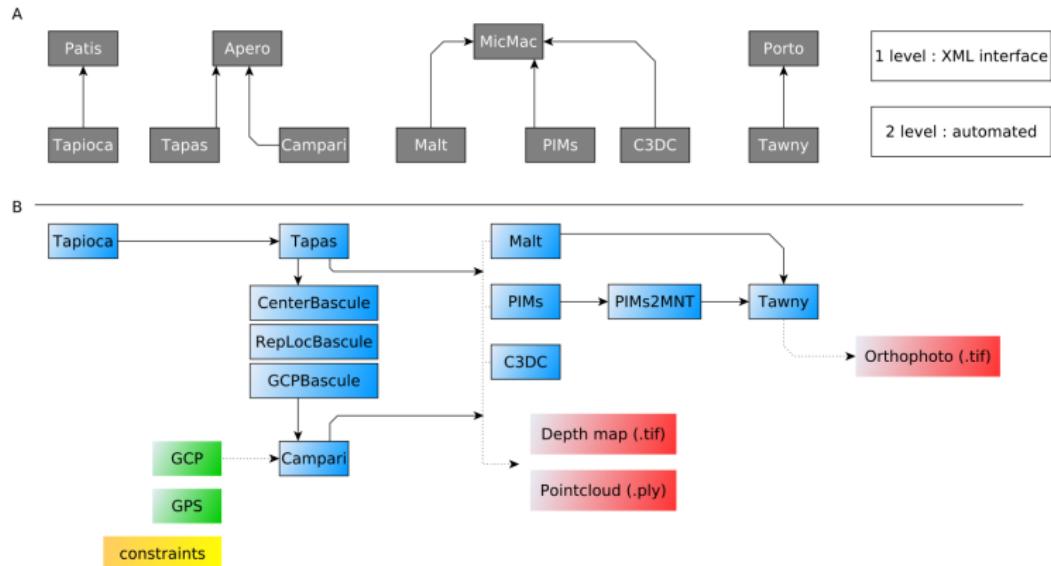
Bundle block adjustment



1

Introduction

Overview of the processing pipeline





2

Tie points
extraction



Tie points extraction

Without a priori geometry

Tie points extraction Without *a priori* geometry

Tie points detection

- ▶ SIFT : default
- ▶ Digeo : slightly faster, possibility to use only max or min
- ▶ AIME (presented by MPD during spotlight), under developpment; generally faster than SIFT

Tie points Matching

- ▶ ANN (Approximate Nearest Neighbor)
- ▶ for a point in pic A, find best and second best points in pic B. The best point is accepted if his score is high and second best score is low.

Tie points extraction Without *a priori* the geometry

Extraction organization : lists of pictures pairs

- ▶ All, MulScale, Line...
- ▶ from an orientation (GPS, approximate orientation)

Tapioca command. See §3.3 and §16 of documentation.

Tie points files format (binary and ASCII)

- ▶ Default : 1 file per pair, simple and universal
- ▶ New format : 1 file with points multiplicity, faster but only usable with few commands

mm3d TestLib ConvNewFH command. See §16.8 of documentation.



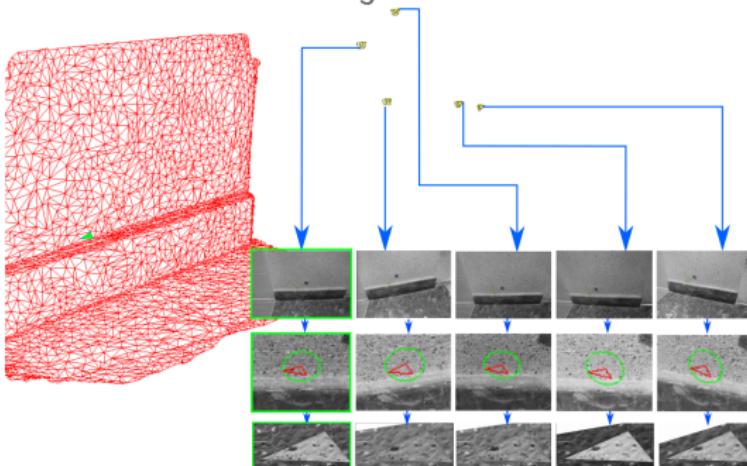
Tie points extraction

With a priori geometry

Tie points extraction With *a priori* geometry

- ▶ “Second iteration”: using camera orientations and a 3d mesh
- ▶ finds tie points with good repartition on pictures and 3d mesh
- ▶ use orientations for perspective corrections before correlation

mm3d TiePTri command. See §16.9 of documentation.





2

Tie points extraction

Reduction algorithms

Tie points reduction algorithms

Four tools are dedicated to Tie points reduction:

- ▶ **RedTieP / Schnaps** (generic case): only one point per picture part, favor manifold
- ▶ **OriRedTieP / Ratafia** (quasi-vertical case) : favor scene repartition

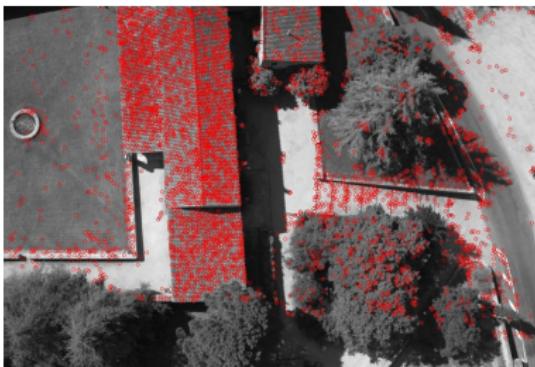




Image orientation

Image orientation Approaches

1. no a priori, iterative (i.e. SfM)
2. with a priori, collinearity-based bundle block adjustment (BBA) when initial orientations are known
3. structureless BBA

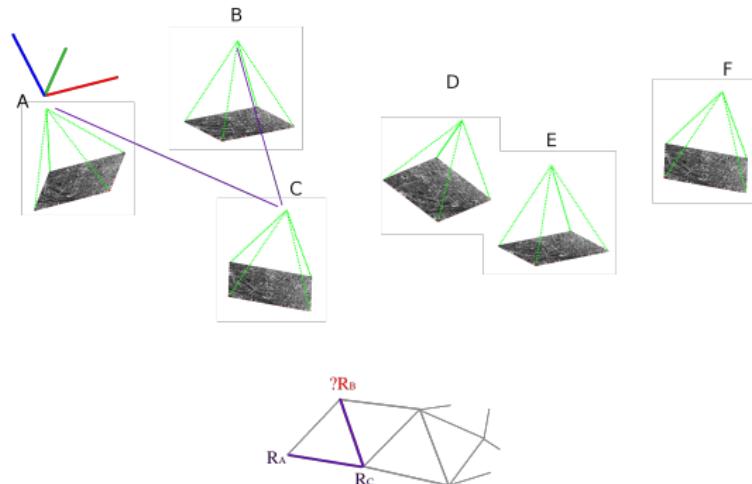


Image orientation

SfM and structureless BBA

Pipeline:

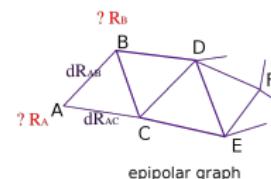
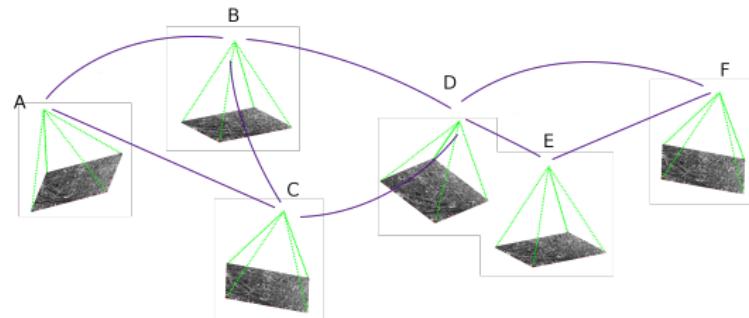
- ▶ **iterative** creation of global poses
- ▶ all poses in the coordinate system attached to a selected camera
- ▶ direct algorithms
(e.g. essential matrix, resection)
- ▶ bundle block adjustment
every n images



Structureless BBA

Pipeline:

- ▶ relative poses between all possible pairs **simultaneously**
(i.e. epipolar graph)
- ▶ composition of triplets
- ▶ initialisation of global poses and error averaging



SfM and structureless BBA

- ▶ in MicMac

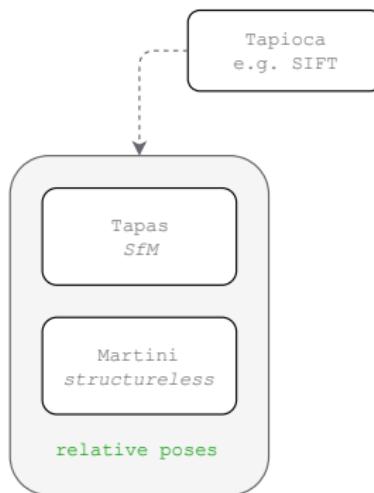




Image orientation

Bundle block adjustement

Bundle block adjustement (BBA)

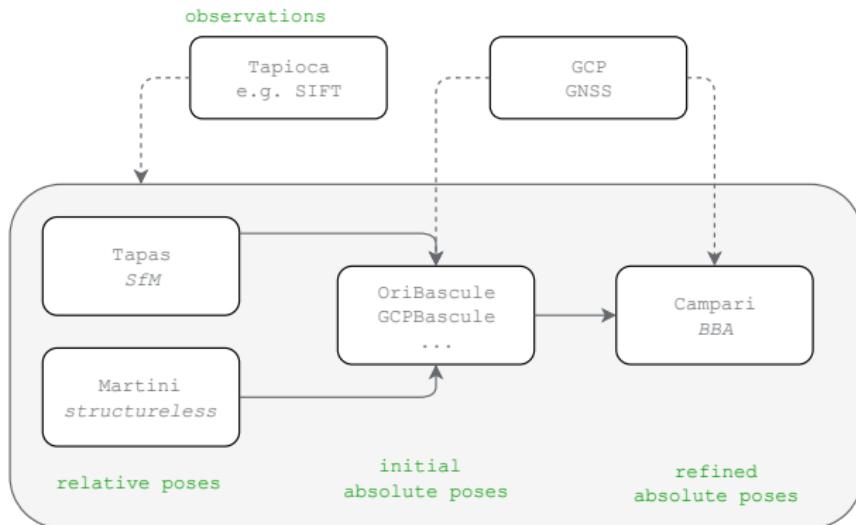
- ▶ collinearity equations
- ▶ non-linear → **initial poses necessary**
- ▶ heterogenous observations/parameters possible:
 - ▶ Ground Control Points (GCP),
 - ▶ GNSS,
 - ▶ lever-arm,
 - ▶ rigid bloc

BBA adopted in

1. SfM, always the same relative system initialisation not an issue
2. absolute positioning
 - ▶ input1: poses known in relative coordinates (SfM output)
 - ▶ input2: GCP, GNSS are given in absolute coordinates
 - ▶ **Transform from relative to absolute coordinates**
 - ▶ rigid spatial similarity transformation (SST) (i.e. 7-param)
 - ▶ "non-rigid" SST (i.e. 7-param + a polynomial)

Bundle block adjustement (BBA)

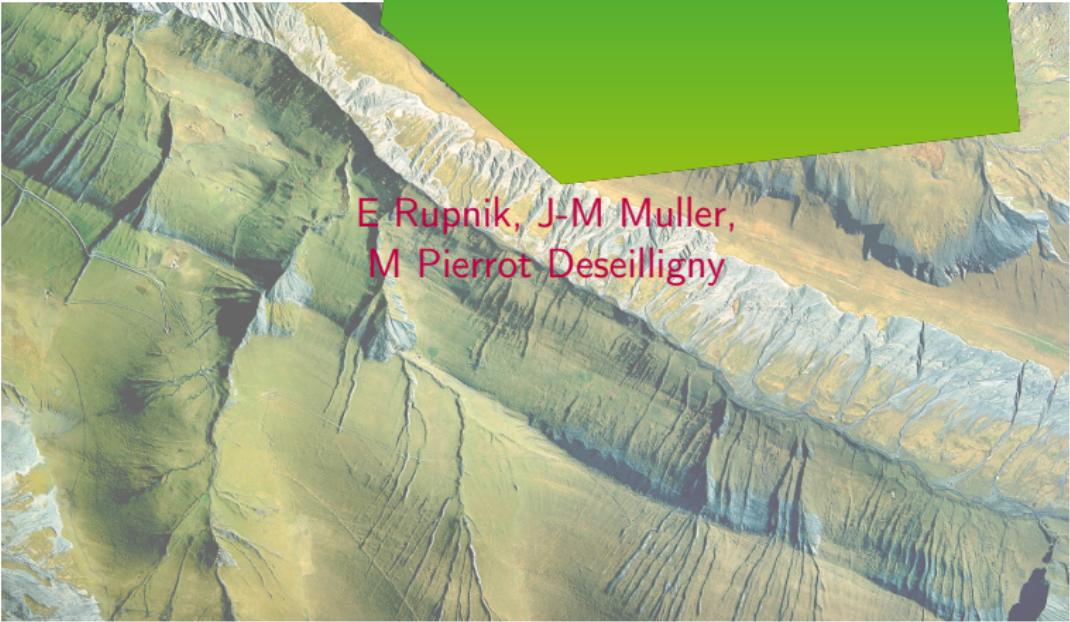
► in MicMac





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Thank you for your
attention!



A large aerial photograph of a mountainous region, likely the Alps, occupies the lower half of the slide. The terrain is a mix of green pastures, blue lakes, and rocky mountain peaks. In the center-left of this image, there is a semi-transparent white rectangular box containing the names of the speakers.

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