The project Symmetry

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Objective 1 (“Computer Science”)

- Advanced reflectional symmetry
  - Non-uniform data, corrupted data, local symmetries
  - Mostly fulfilled explicitly by the original method by Hruda et. al., local symmetries tough but done
- Rotational, axial symmetry, groups of symmetry
  - Rotational symmetry done, the rest can hopefully be ignored
- More general types of symmetry
  - Non-planar “mirror” – E. Mourycová, M. Safko – looks like a publishable material
  - Planar mirror, more general transformations – V. Poór – in the beginning
  - Generalized rotational symmetry – pipelines, curved axis – so far only BPs, needs more work o get something publishable

Objective 1 (“Computer Science”)

- Symmetry of continuously described objects
  - Not done but it is in fact fulfilled by the math group
  - If this implicit solution were not acceptable, what to do with it?
  - No hope to start from zero
  - Maybe some comparison of our math and CS approaches results on some intersection’ data + experiments with sampling but so far there is no free manpower to do it
- Approximate symmetry
  - Evaluation of the measure of symmetry – M. Maňák – publishable material
  - User tests – one paper nearly finished (Kolingerová, Mourycová, Anděl et. al.)
  - CTU cooperation in user testing – communication problems, all is too much dragging on my taste

Objective 1 (“Computer Science”)

Possible future subtopics

- More of generalized symmetry
  - The problem: less user-friendly – difficult to understand and check
- Intrinsic symmetry – difficult but there would be a good relation to M. Safko’s intrinsic triangulations and to time-variant objects by L. Váša’s team
- Symmetrization
- …

Objective 2 (Mathematics)

- Equivalences of finite sets of points
- Exact projective (and other) equivalences between algebraic surfaces in 3-space
- Approximate projective equivalences of special algebraic varieties
- Approximate symmetries of perturbed objects

Objective 3 (Earth Observation Data processing)

- Initial study of reflectional symmetry detection in EO data
  - Maribor LiDAR data sets used in tests in Pilsen.
  - Czech algorithm used in Maribor for symmetry detection in satellite images.
  - GIS platform implemented.
  - Own refelection symmetry detection algorithms developed.
- Symmetry-aware feature extraction in EO data fusion
  - Objects extracted and processed by global symmetry detection. Classification tasks enhenced by the detected symmetries (Cerknica lake use case).
  - General methodology not feasible within the project, so „personalized“ solutions for individual use cases are necessary.

Objective 3 (Earth Observation Data processing)

- Integration of symmetries into semantic segmentation and object recognition in EO data fusion
  - 2 pilots chosen (Railway detection; Some steps towards tree species classification).
  - Data model for symmetry integration at individual data fusion levels developed at conceptual level. Implementation simultaneously with both pilots (still on time).
- Validation of symmetry utilization in EO data applications
  - Pilots implemented (in advance). Improvements and publications in progress.
- Objective 3 dissemination
  - 2/3 (published/mandatory) conference publications
  - 5/4 journal papers (3 more in preparation, 1 of them for conference, 4th later)
  - 1/0 scientific book chapters
  - 1/0 patent application