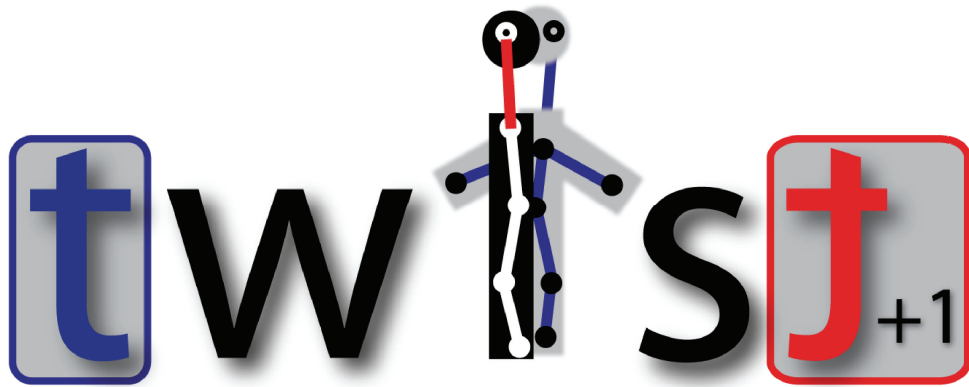




Tracking with Structure in Computer Vision

REPORT

2007

April 22, 2008

<http://www.prip.tuwien.ac.at/Research/twist/twist.php>

Tracking with Structure in Computer Vision

twist₊₁

R E P O R T

2007

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Abstract. This project is supported by the Austrian Science Found - Fond zur Foerderung der wissenschaftlichen Forschung - (FWF) under the grant FWF-P18716-N13. A short summary of topics studied in the second project year (2007) are presented. A list of presentation and of publications is given as well. Publications cited in this document can be found at the project web page.

1 Summary

Further work has been done on the eccentricity transform. Very promising results are achieved in 2D shape matching [1]. Optimizations for the computation of the eccentricity transform of both convex [2] and polygonal [3] shapes have been developed. Shape matching can be used to identify different objects and parts of them in difficult video sequences.

Irregular pyramids are made of a stack of successively reduced graphs embedded in the plane. Such pyramids are used within the segmentation framework to encode a hierarchy of partitions. The different graph models used within the irregular pyramid framework encode different types of relationships between regions [4]. Segmentation using pyramids combined with an optical flow feature detector is studied in [5].

Irregular graph pyramids have also been applied to homology computation. Methods to compute and to control the geometry of the homology generators using pyramids have been developed [6, 7]. Homological features are useful for tracking as they are invariant over time for the same object.

More detailed experiments relating story-board human description of video sequences are presented in [8].

We tested human performance on the Euclidean Traveling Salesman Problem and on the Minimum Spanning Tree problem [9]. It seems that humans use heavily relation between points of interest. This studies will help us in understanding how human attention mechanism groups interest points, which would have impact in studying the analysis of videos.

Graph-based wavelets on spatio-temporal data are proposed in [10] for computer vision tasks.

2 List of Topics with Publications

Our work concentrated on these topics:

- Image transformation: Eccentricity image transformation [3, 2],
- Shape matching using eccentricity transform [1],
- Segmentation using graph pyramids [4, 5],
- Human-like descriptions of videos [8],
- Human problem solving of the traveling salesman problem [9] (joint work with Purdue University),
- Homology group computation [6, 7] (joint work with University of Poitiers).
- Graph-based wavelets on spatio-temporal data [10].

3 Presentation and Attendance

3.1 Walter G. Kropatsch

- Ibero-american Conference on Pattern Recognition, CIARP, Via del Mar-Valparaiso, Chile, November 2007 [3].
- Austrian Pattern Recognition Workshop, AAPR, Schloss Krumbach, Austria, May 2007 [1].
- Computer Analysis of Images and Patterns Conference, CAIP, Vienna, Austria, August 2007 [2, 10].
- Computer Vision Winter Workshop, CVWW, St. Lambrecht, Austria, February 2007 [7].
- Wintergraph, Nassfeld, Austria, March 2007, Presentation. Research at PRIP.
- Workshop on Graph based Representations in Pattern Recognition, GbR, Alicante, Spain, June 2007 [9, 6].
- Third Six-Monthly euCognition Meeting, Munich, June 2007.

3.2 Yll Haxhimusa

- Computer Analysis of Images and Patterns Conference, CAIP, Vienna, Austria, August 2007 [2].
- Workshop on Graph based Representations in Pattern Recognition, GbR, Alicante, Spain, June 2007 [9, 6].
- Computer Vision Winter Workshop, CVWW, St. Lambrecht, Austria, February 2007 [7].

3.3 Marie Wild

- Computer Analysis of Images and Patterns Conference, CAIP, Vienna, Austria, August 2007 [10].

3.4 Adrian Ion

- Austrian Pattern Recognition Workshop, AAPR, Schloss Krumbach, Austria, May 2007 [1].
- Computer Analysis of Images and Patterns Conference, CAIP, Vienna, Austria, August 2007 [2].
- Computer Vision Winter Workshop, CVWW, St. Lambrecht, Austria, February 2007 [7].
- Workshop on Graph based Representations in Pattern Recognition, GbR, Alicante, Spain, June 2007 [9, 6].
- Third Six-Monthly euCognition Meeting, Munich, June 2007.

3.5 Samuel Peltier

- Computer Analysis of Images and Patterns Conference, CAIP, Vienna, Austria, August 2007 [2].
- Workshop on Graph based Representations in Pattern Recognition, GbR, Alicante, Spain, June 2007 [6].
- Computer Vision Winter Workshop, CVWW, St. Lambrecht, Austria, February 2007 [7].

3.6 Martin Stubenschrott

- Practicum. Combining an Optical Flow Feature Detector with Graph-Based Segmentation. Technical Report [5].

3.7 Andreas Hubner

- How Humans Describe Short Videos - Details of an Experiment. Technical Report [8]

4 Cooperation

- Zygmund Pizlo, Purdue University, USA.
 - Human Problem Solving [9].
- Guillaume Damiand, University of Poitiers, France.
 - Homology computation [6, 7].
- Eric Andres, University of Poitiers, France.
 - Discrete geometry. Invited lecturer. New Erasmus contact.
- Gabriel Peyré, Paris Dauphine University, France.

- Shape Matching [1]
- Wilhelm Burger, University of Applied Sciences, Hagenberg, Austria.
 - Video Tracking using Structure.
- Pedro Real and Rocío González, University of Seville, Spain.
 - Video Tracking using Structure.
- Edel García Reyes, Advanced Technologies Application Center, Havana, Cuba.
 - Structural Motion Representation.

5 University Stays

- March 2007. Poitiers, France. Walter G. Kropatsch invited Prof. at the Signal, Image and Communications department.

6 Web Page

In order to disseminate our work, a web page have been started at <http://www.prip.tuwien.ac.ac/twist>.

Some of the publication mentioned above and the source codes used in these publications are offered at this web page.

7 Organization

- Seminar on Image Processing and Pattern Recognition: Structural Pattern Recognition, 3 participants.
- Selective Chapters on Pattern Recognition: Discrete geometry. Invited speaker Prof. Eric Andres.
- Computer Analysis of Images and Patterns Conference, CAIP, Vienna, Austria, August 2007.

8 Employment

Marie Wild left TWIST on July 30, 2007. Salvador Buenaventura López Mármol started working on the project from October 15, 2007. Nicole Maria Artner started on November 1, 2007. At PRIP, a position is to be occupied.

References

1. Ion, A., Peyré, G., Haxhimusa, Y., Peltier, S., Kropatsch, W.G., Cohen, L.: Shape matching using the geodesic eccentricity transform - a study. In W. Ponweiser, M. Vincze, C.B., ed.: The 31st annual workshop of the Austrian Association for Pattern Recognition (OAGM/AAPR), Schloss Krumbach, Austria, OCG (2007) 97–104

2. Ion, A., Peltier, S., Haxhimusa, Y., Kropatsch, W.G.: Decomposition for efficient eccentricity transform of convex shapes. In Kropatsch, W.G., Kampel, M., Hanbury, A., eds.: CAIP. Volume 4673 of Lecture Notes in Computer Science., Springer (2007) 653–660
3. Kropatsch, W.G., Ion, A., Peltier, S.: Computing the eccentricity transform of a polygonal shape. In Rueda, L., Mery, D., Kittler, J., eds.: CIARP. Volume 4756 of Lecture Notes in Computer Science., Springer (2007) 291–300
4. Kropatsch, W.G., Haxhimusa, Y., Ion, A.: Multiresolution Image Segmentations in Graph Pyramids. In: Applied Graph Theory in Computer Vision and Pattern Recognition. Volume 52 of Studies in Computational Intelligence. Springer (2007) 3–42
5. Stubenschrott, M.: Combining an optical flow feature detector with graph-based segmentation. Technical Report PRIP-TR-112, PRIP, TU Wien (2007)
6. Peltier, S., Ion, A., Haxhimusa, Y., Kropatsch, W.G., Damiand, G.: Computing homology group generators of images using irregular graph pyramids. In Escolano, F., Vento, M., eds.: GbRPR. Volume 4538 of Lecture Notes in Computer Science., Springer (2007) 283–294
7. Peltier, S., Ion, A., Haxhimusa, Y., Kropatsch, W.G.: Controlling geometry of homology generators. In Grabner, M., Grabner, H., eds.: Proceedings of the 12th Computer Vision Winter Workshop, Graz University of Technology, Institute for Computer Graphics and Vision, Verlag der Technischen Universitt Graz (2007) 115–121
8. Hubmer, A., Ion, A., Kropatsch, W.G., Haxhimusa, Y., Hausegger, H.: How humans describe short videos - details of an experiment. Technical Report PRIP-TR-113, PRIP, TU Wien (2007)
9. Haxhimusa, Y., Kropatsch, W.G., Pizlo, Z., Ion, A., Lehrbaum, A.: Approximating TSP solution by MST based graph pyramid. In Escolano, F., Vento, M., eds.: GbRPR. Volume 4538 of Lecture Notes in Computer Science., Springer (2007) 295–306
10. Wild, M.: Nonlinear approximation of spatiotemporal data using diffusion wavelets. In Kropatsch, W.G., Kampel, M., Hanbury, A., eds.: CAIP. Volume 4673 of Lecture Notes in Computer Science., Springer (2007) 886–894