FP6-513663

FLUID
FLUId Image Description and analysis

Instrument: Strep
Priority: IST FET OPEN

Plan for using and disseminating the knowledge

Due date of deliverable: 30/11/07
Actual submission date: 20/12/07

Start date of project: 01/12/04
Duration: 3 years

Organisation name of lead contractor for this deliverable: INRIA

Revision [1]

<table>
<thead>
<tr>
<th>Dissemination Level</th>
<th>Public</th>
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<tbody>
<tr>
<td>PU</td>
<td>Restricted to other programme participants (including the Commission Services)</td>
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<tr>
<td>PP</td>
<td>Restricted to a group specified by the consortium (including the Commission Services)</td>
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<tr>
<td>RE</td>
<td>Confidential, only for members of the consortium (including the Commission Services)</td>
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1 – Exploitable knowledge and its use

As part of the FLUID project LaVision has considerably improved on its 3D Tomographic PIV technique (WP 4.2):

- Improvement of the technique especially by using volumetric self-calibration patent granted for volume self-calibration (in D, filed also internationally)
- Very positive response of the 3D Tomographic-PIV technique in the fluid dynamic community
- First sales of measurement systems
- Advantage compared to the (US-)competition
- Potential to include variational approach and physical laws (results of WP 2+3)

A new collaboration has started between LaVision and Chr. Schnörr, Uni. Mannheim and A. Schröder, DLR Göttingen concerning advanced tomographic reconstruction techniques, funded by DFG Germany.

Another subject of exploitation relates to the different optical flow techniques developed within FLUID for processing scalar (LIF, etc.) images (results of WP 2). LaVision plans to offer a special software package to analyze LIF images.

There is a promising potential of using combined correlation+optical-flow (e.g. Cemagref-INRIA) and variational correlation approach (Uni Mannheim) for 2D-PIV flow field measurements. Further work is needed to validate these approaches.

The Cemagref and INRIA groups have decided to propose to their respective general management boards the creation of a common and transversal research group on the study of fluid flows from image sequences. This group will focus on the study of geophysical flows and industrial flows for analysis and control purposes. We believe there is a huge potential of satellite fluid image analysis for environmental analysis in meteorology, oceanography and climatology but also to analyze accurately on long time range human activities evolution. This concerns questions of deforestation, monitoring of forest fires, desertification, impacts of repetitive natural disaster on lands, city growing etc. The question of flow control is also of major interest for industry and we believe that image analysis could bring in this context interesting solutions. All these research issues, which are of major interests for the society, are prolongations of the techniques proposed within the FLUID project.

The submission of another European project focusing on image analyses for 3D flows, flow control, geophysical flows and environmental applications is planned. We intend to submit a proposal with more ambitious objectives and an enlarge number of people involved. We believe these questions of analysing fluid flows from images are essential with respect to a great number of applications. The FLUID project was in that prospect a very interesting starting point that provides us some advances compared to international competition.
2 – Dissemination of knowledge

- According to the FLUID project work plan the following deliverables have been elaborated during this reporting period:

  - F. Becker and C. Schnörr Report on Motion Estimation Based on Convex Problem Decomposition, Deliverable 2.5
  - C. Schnörr, Final report on Motion estimation for fluid flows, Deliverable #2.6
  - N. Papadakis, E. Memin, N. Gengembre, Demonstrator on vorticity tracking method for fluid flows, deliverable #3.3
  - N. Papadakis, Juan D'adamo, Etienne Memin and Guillermo Artana, Demonstrator on turbulent structure characterization deliverable #3.4
  - E. Mémin, Final report on WP3: Representation, Tracking methodologies, and Characterization of fluid flows from images sequences. Deliverable #3.5
  - P. Heas E. Mémin Demonstrator on motion layer estimation method, deliverable #4.1
  - AMI group, Demonstrator on 3D fluid flow estimation methods, Deliverable #4.2
  - L. Alvarez, Final report on WP4: 3D estimation of fluid flows from images sequences. Deliverable 4.3
  - G. Arroyo, J. Carlier, D. Heitz, A. Szantai, Final report on the evaluation of the taks of the workpackage 2, Deliverable #5.4
  - G. Arroyo, J. Carlier, D. Heitz, A. Szantai, Final report on the evaluation of the tasks of the workpackage 3, Deliverable #5.5
  - G. Arroyo, J. Carlier, D. Heitz, A. Szantai, Final report on the evaluation of the tasks of the workpackage 4, Deliverable #5.6
  - E. Mémin, “Periodic intermediate management report”, Deliverable 6.3a, 6.3b
  - E. Mémin, “Periodic activity report”, Deliverable 6.4c

- During the reporting period, several research articles related to the FLUID project have been accepted or submitted for publication in national and international refereed conferences and journals. Here is a list of these articles:

  **Journals**

  **Published/accepted:**


7. N. Papadakis and E. Mémin. A variational technique for time consistent tracking of curves and motion, accepted for publication under minor revisions *International Journal on Mathematical Imaging and Vision (IJMIV)*


**Under revision:**


**Submitted:**


23. B. Wieneke, Volume Self-Calibration for Stereo-PIV and Tomographic-PIV, Selected for the Special Issue on « PIV’07 » in Experiments In Fluids

In preparation:


Conferences

Published/accepted:


34. A. Szantai, E. Mémin, A. Cuzol, N. Papadakis, P. Héas, B. Wieneke, L. Alvarez, F. Becker, and P.-W.Lopes. Comparison of MSG dense

35. D. Heitz, P. Héas, V. Navaza, J. Carlier, E. Memin. Spatio-temporal correlation-variational approach for robust optical flow estimation. In 7th International Symposium on Particle Image Velocimetry (PIV’07), Sept. 2007 - has been selected for ’Special Issue of PIV’07‘ in Exp. In Fluids.


Below we list the impact factor of the different journals publications or submissions related to this project


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<tr>
<th>Journal</th>
<th>Papers number</th>
<th>Impact factor</th>
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<tbody>
<tr>
<td><em>International Journal of Computer Vision (IJCV)</em></td>
<td>2</td>
<td>6.085</td>
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<tr>
<td><em>Journal of Turbulence</em></td>
<td>2</td>
<td>1.06</td>
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<tr>
<td><em>Experiments in Fluids</em></td>
<td>4</td>
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<tr>
<td><em>Journal on Mathematical Imaging and Vision.</em></td>
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<td><em>IEEE Transactions on Geosciences and Remote Sensing</em></td>
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<td><em>Measurement Science and Technology</em></td>
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<td><em>SIAM J. Scientific Computing</em></td>
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<td><em>Physics of fluids</em></td>
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<td><em>Pure and Applied Geophysics</em></td>
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<td><em>Tellus Series A: Dynamic meteorology and oceanography</em></td>
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<td><em>Lecture notes on Computer Sciences</em></td>
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<td><em>IEEE trans. On Signal processing</em></td>
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<td><em>IEEE trans. On Pattern Analysis and Machine Intelligence</em></td>
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<td><em>Computer Vision and Image Understanding</em></td>
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<td><em>Journal of Fluid Mechanics</em></td>
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<tr>
<td><em>SIAM Journ on Imaging Sciences</em></td>
<td>1</td>
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All these articles and deliverables are available on the FLUID web site: [http://www.fluid.irisa.fr](http://www.fluid.irisa.fr). These publications have been organized according to different keywords. They can be selected also by year or by authors.

As can be seen the publication of the studies performed within the FLUID project are composed of first rank international journal in Computer Vision, Experimental fluid mechanics, applied mathematics and Geosciences.
The works done within this project have been presented in several international conferences. These conferences focused either on Computer Vision, fluid flow visualization, or Geosciences and Meteorology issues.

- The FLUID project contributed to form 6 PhD students and 8 post-doctoral fellows. Among the PhD students, four of them have defended their PhD.

Symposium organization

Etienne Mémin and Christoph Schnörr have organized with J.-P. Bonnet (LEA/CNRS) and C. Troppea (TU Darmstadt) an international symposium on Experimental Fluid Mechanics, Computer Vision, and Pattern Recognition at Schloss Dagstuhl, Germany, Spring 2007, involving about 35 leading researchers involved in experimental fluid mechanics, fluid flows visualization and image analysis. This seminar has been a great success. It has allowed people of three different communities to share their point of view on close objectives concerning fluid flows analysis and the visualization/restitution of flow features. Dantec and La Vision have sponsored this meeting. A paper summarizing this seminar will be published in the journal “Experiments in Fluids”. The summaries of the different presentations are available on the Dagstuhl website: http://kathrin.dagstuhl.de/07121/Materials2/

Christoph Schnörr has Co-organized of the Annual Conference of the German Association for Pattern Recognition (DAGM).

Dominique Heitz has organized a national CNRS meeting on the Structure of Turbulence, with special sessions on Image and model based measurement techniques, Assimilation techniques. This meeting was initially scheduled in November 2007 but due to the social context of this period, the meeting has been postponed to January 2008 (28-29-30 January 2008). More information are available on the website of the meeting: http://gdr-turbulence.pmmh.espci.fr/Jan2008/jan2008.html