Progress Report Submission for C. J. Taylor

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27th January 2004

Agreed Upon

- Experiment further with model-based objective function and discover the causes for the current weaknesses. Produce figures that reflect on the optimisation and try simpler warps. More specific details are given in the next section.
- Change of the presentation abstract according to suggestions made throughout the meeting.
- Form 3 needs to be submitted to Shelagh.
- The project presentation will be looked at during the next meeting.
- Feedback on the contents of the literature report will be brought in next meeting.

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Electronic version: http://www.danielsorogon.com/Webmaster/Research/Progress

- Implementation and code need to be discussed in greater depth in future meetings.

Progress Made

Before January 25th

Presentation

- **January Presentation Abstract** has been modified.

  `http://www.danielsorogon.com/Webmaster/Research/2004_Abstract`

  The modifications were very small – mainly riddance of inadequate phrasing and minor compensation for the way ideas were expressed in the previous revision.

- The presentation has been updated at its own volition to show illustrative structural figures at its end.

  `http://www.danielsorogon.com/Webmaster/Research/January_Presentation_Concise`

Experiments

- The MATLAB code was largely extended and made more sophisticated.

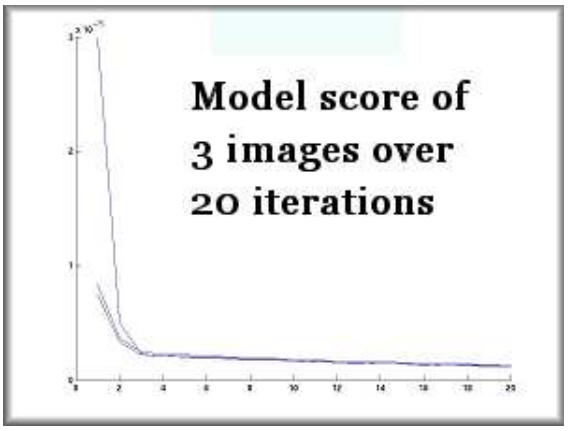
- Newer images and videos are available under:

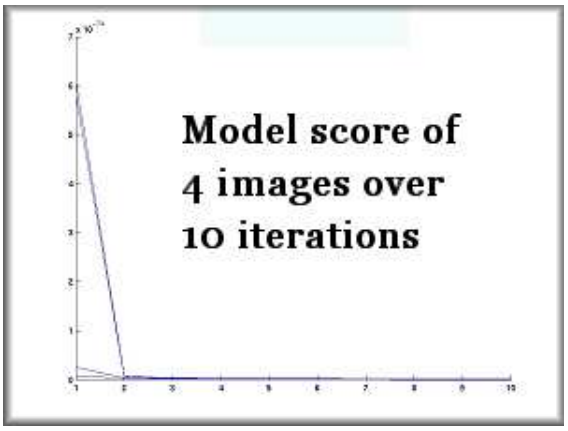
  `http://www2.cs.man.ac.uk/~schestr0`

  Some results from experiments are available under the results page.

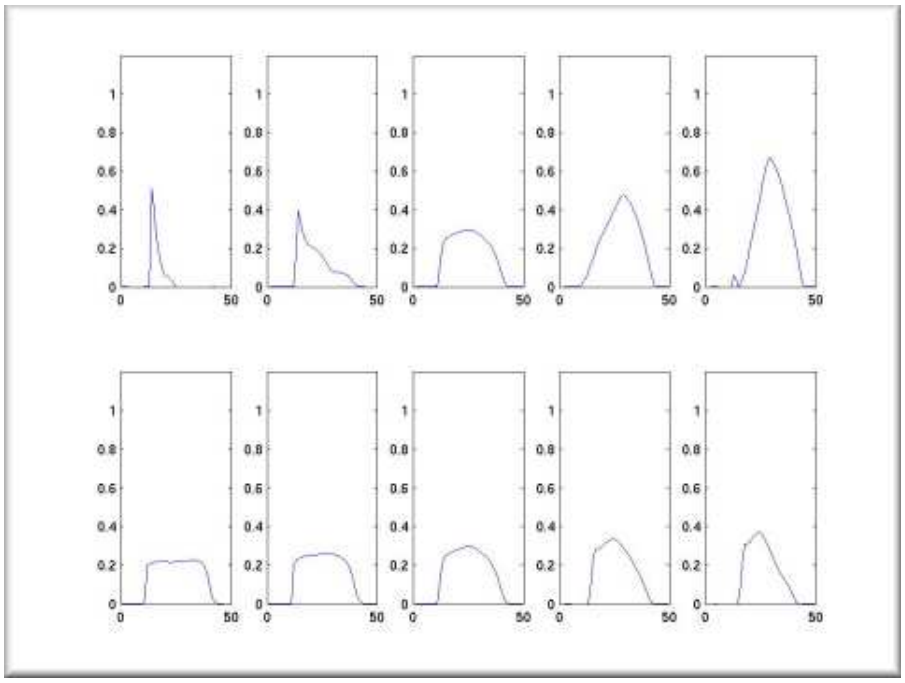
  `http://www.danielsorogon.com/Webmaster/Research/NRR/Results`

- The optimisation for the model-based case possesses some mysteriously bad characteristics. The functions were investigated in great depth and the following observations made.





The figures above clearly indicate that the optimisation extent quickly becomes futile as the dataset size grows. For sets greater than 3 in size, only the first iteration entails an improvement and the optimisation's nature is even discouraging if the set is of a more realistic size, e.g. 10 or 30.



The figure shows the modes of variation for a combined model of only 4 bumps aligned over 10 iterations. The 2 most significant modes of variation show that the model created is poor indeed.

- Work still attempts to show that there is a fundamental problem with the way in which a model is constructed or evaluated because iterative improvements are surprisingly disappointing. For 2 images, little improvement is made after about 5 iterations or in some cases 10. For sets of greater size, results are horrible regardless of the (1) objective function; (2) knot-point placement method; (3) warp complexity. Advantageous alternatives to these three components will need to be discovered.

- Important details and issues raised in the meeting with Stephen Marsland have been put in a separate document. The document is *still* worth having a glance at during one of the next meetings.

  `http://www.danielsorogon.com/Webmaster/Research/NRR/Marsland`

Journals

- Addition to journals list: *Medical Image Analysis* from Elsevier Science (accessible from SwetsWise). It was included in Prof. Noble's site and it appears to include plenty of papers on registration.

- Access to IJCV was very recently made available through JRULM. It was therefore added to the list journals to be regularly browsed *on-line*. All of the 11 journals initially targeted, plus the aforementioned 12th journal, are now available electronically.
- Major overhaul of journals page makes access to papers even easier and quicker.

  `http://www.danielsorogon.com/Webmaster/Research/Links/journals.htm`

Organisational

- Form 3 and a copy of the literature report have been handed in to Shelagh. Student Talks tape will be returned to her soon.
- Miscellaneous meetings[1] are recorded at:

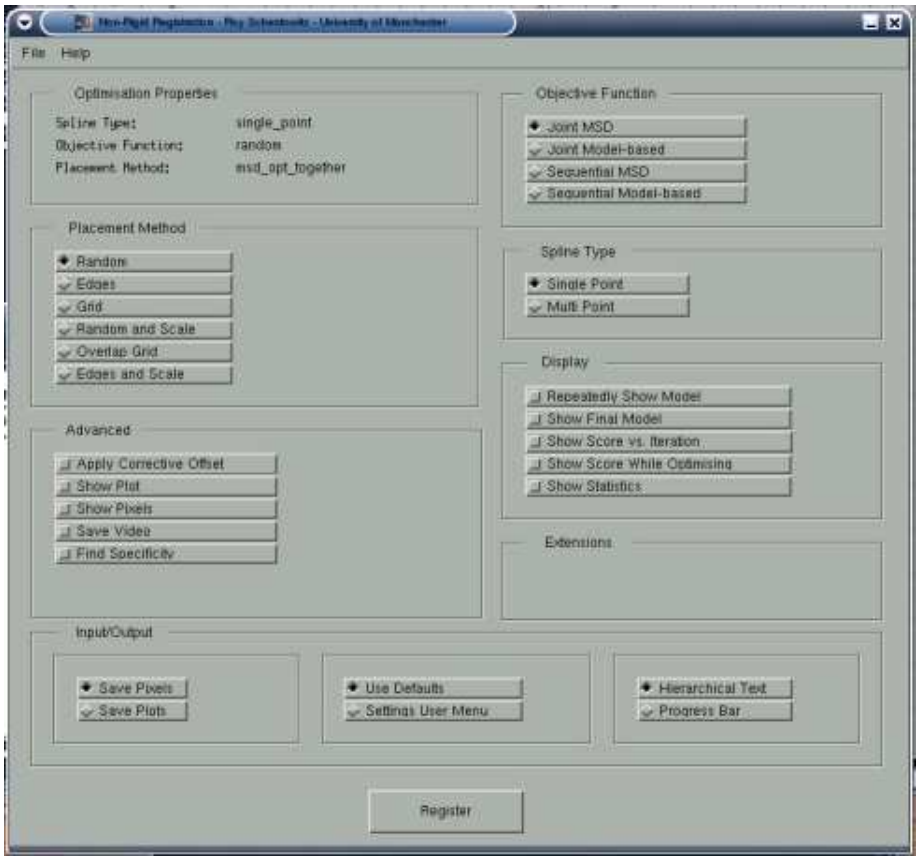
  `http://www.danielsorogon.com/Webmaster/Research/Meetings/`

After January 25th

- Properties of the generated bumps were required be tweaked to perfection once the objective function behaved sensibly. However, bumps generation routines were substantially improved by Sunday and registration performance was merely affected, just as had been expected.
- NMI[2] has been used as an alternatives to MSD and combined models, but this did not serve the purpose of the project, apart from the obtaining of comparative results.
- Intensity offsets as a pre-processing step have been fully implemented. They have also been added to the plots presentation.
- Plots show dynamic scores for of each image to assist debugging.
- The user interface construction is finally completed. The figure below is intended to be self-explanatory.

[1] All meetings apart from the weekly meetings with the supervisor.

[2] The actual implementation is Rhodri's and it is based on a paper from Studholme and Maes.



The new graphical registration tool as of Monday.

- Kola suggested ways in which MATLAB code can be converted into C code and then evolve to utilise VXL.Such transition and compilation are dependent upon MCC (MATLAB Complier) which the faculty holds a licence for. Efforts into acquisition of this software are currently under way.

Next Stage

Implementation

- Critically evaluate MATLAB experiments and results to agree on the next step/s. Find out the differences between the MATLAB

code and TFC's C++ implementation which has been more successful.

- Have a look at the suggestions made by Stephen. Implementation can benefit greatly from discussions stemming from these notes.
- Consider the implementation prospects of MDL as a metric[3], especially as a substitute for the determinant of the covariance matrix.
- Run the package to illustrate the difficulties encountered with model-based function.

Others

- (Possibly) Read the revised abstract.
- Review the more concise presentation slides.
- Have a closer look at parts of the literature report which apparently indicate misconceptions.

[3]The package already has a notion of MDL, but it is not yet implemented.