



Form 10: Supplementary Report of Research Progress

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28th October 2004

Document Structure

This supplement is broken down into sections which address the handbook requirements.

Section 1 covers progress to date.

Section 2 re-iterates future aims and objectives of this research work.

Section 3 identifies areas that need development (in particular skills).

Section 4 provides appraisal of written skills.

1 Progress

The two main objectives of this project are to:

- Make construction of appearance (combined) models autonomous.
- Register a collection of images using the minimum description length (MDL) principle.

It is worth mentioning that the two problems are closely-coupled. Having found a solution to one, the other should be solvable as well. Throughout the first year, and particularly at the beginning of the second one, a method was devised to solving the problem on a small scale. However, new difficulties emerged and the practicality of this method was overshadowed by doubt. Here are a few milestones of progress:

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1. Sets of 1-D images could be registered based on MDL.
2. The optimisation regime was substantially improved.
3. The correct solution to the registration problem was identified.
4. Correct combined models were constructed at the correct solution.
5. It was realised that the correct solution can be missed.
6. Refinement of combined model in the process of registration became apparent.

2 Future Aims and Objectives

The objectives remain similar to the original ones, yet new additional problems must be tackled first. The following are some of the more important challenges:

1. Improving the search method.
2. Including a component for model discrepancy in the objective function.
3. Obtaining plausible registration results while constructing appearance models that encapsulate the expected variation.
4. Learning about the robustness of the method.
5. Investigating the quality of the results.
6. Re-writing the objective function to calculate a proper MDL term¹.
7. Extension of the method to 2-D and 3-D.
8. Conduct experiments to show the advantages of:
 - Registration based on an MDL criterion.
 - Automatic construction of appearance models².

3 Areas of Development

- Improvement of my ability to communicate my work.
- Identifying the right experiments to perform.
- Changing the way results are summarised and discussed among peers.

4 Appraisal of Written Skills

Self-appraisal is difficult, but here are various issues I am aware of:

- My sentences tend to be long and difficult to follow sometimes.
- My writing style was said to be verbose.
- Expressing ideas in brevity and simplicity is essential for easier communication and it needs some further work on.
- Structuring of documents has a place for improvements.

¹MDL is currently approximated by looking at the determinant of the covariance matrix.

²This can be compared to a manual or semi-manual procedure. It can also be compared to other methods, e.g. mutual information-based registration and statistical deformation models.