

# **A System For Video-Based Spatiotemporal Data Capture, Query And Visualisation: The Case Of Team Games**

Antoni Moore, Peter Whigham, Alec Holt, Colin Aldridge and  
Ken Hodge\*

Spatial Information Research Centre, Department of Information Science, /

\*School of Physical Education, University of Otago,

PO Box 56, Dunedin, New Zealand;

Tel: +64 3 4798138;

Fax: +64 3 4798311;

Email: [amoore@infoscience.otago.ac.nz](mailto:amoore@infoscience.otago.ac.nz)

## **Biography**

Lecturer in Spatial Information, University of Otago, NZ (2002-)

Recently completed PhD (Geographical Sciences, University of Plymouth, 2002) on reasoning with uncertainty in the context of a knowledge-based system for Integrated Coastal Zone Management.

Research interests also include spatial data structures, cartographic generalisation and visualisation (spatio-temporal, uncertainty)

## **Introduction**

There are many spatial phenomena that operate in a limited space, whether by nature or constrained by artificially-imposed boundaries. Two cases include animals living within their respective ecosystems (as an example of the former) and the behaviour of players in the context of team games. It is apparent that with both cases, the temporal dimension is an essential construct towards understanding and visualising spatial patterns, as such patterns are subject to constant change.

Conventional spatial data capture techniques are used so as to maximise spatial coverage – remote sensing has relatively poor temporal resolution to achieve a large spatial footprint, and ground survey using GPS is conventionally used to maximise coverage at the expense of frequency. However, in the case of a small constant area, temporally intensive data capture is possible but relatively unexplored. This scenario is set to become increasingly important with research into mobile and compact technologies which promise to generate an abundance of spatiotemporal data.

## **Aims Of The Research**

In this paper, we take the example of spatiotemporal data capture from video recordings of rugby union matches. The dimensions of the rugby pitch form a spatial constraint to player pattern, and the video medium is a raw data source with a near-continuous timeline for this spatial behaviour, making the application eminently suitable for the study of spatiotemporal data.

This paper details progress on a system for what could be called secondary data capture, in trying to elicit explicit spatiotemporal data from a resource that is the result of primary data capture, the video. This is an example of a Video Information System, which takes advantage of what is the most common raw data source for sports analysis (Chang and Lee, 1997). The system, called SCRUM (Spatio-

Chronological Rugby Union Model), also deals with spatiotemporal queries and calls upon a suite of visualisation techniques, some based on space-time geography research (e.g. Gatrell and Gould, 1979). Initial visualisation ideas are reported on in Moore et al (2001) and are not covered in this paper.

## **The System**

The basic architecture of the system encompasses a tree-based taxonomy of objects (e.g. players, referee, ball), events (kick, pass) and templates (unique combinations of objects and events comprising a set play or tactic). These are the elements of the spatiotemporal abstraction from the video, comprising the results of the secondary data capture. In addition there is a database storing instantiations of the above in such a combination as to capture the spatiotemporal components of a rugby video, which, in its original raw form contains no explicit spatiotemporal data. The recording mechanism for the data capture is via a 3D representation of the rugby field, with objects superimposed (these objects are capable of a subset of actions) and moved as the game unfolds on digital video (the display and control of which forms another part of the system), their spatiotemporal coordinates being stored periodically in the database.

As well as being an example of spatiotemporal data capture, the system represents a pioneering application of the space and time approach to team sport.

Chang, C-W and Lee, S-Y. (1997) A Video information system for sport motion analysis. *Journal of Visual Languages and Computing*, 8, 265-287.

Gatrell, A and Gould, P. (1979) A micro-geography of team games: Graphical explorations of structural relations. *Area*, 11, 275-278.

Moore A B, Whigham P A, Aldridge C, Holt A and Hodge, K. (2001) Rugby: (a) union of space and time. In: P A Whigham (ed), *Proceedings of the 13<sup>th</sup> Annual Colloquium of the Spatial Information Research Centre*, University of Otago, Dunedin, New Zealand. 183-194.