

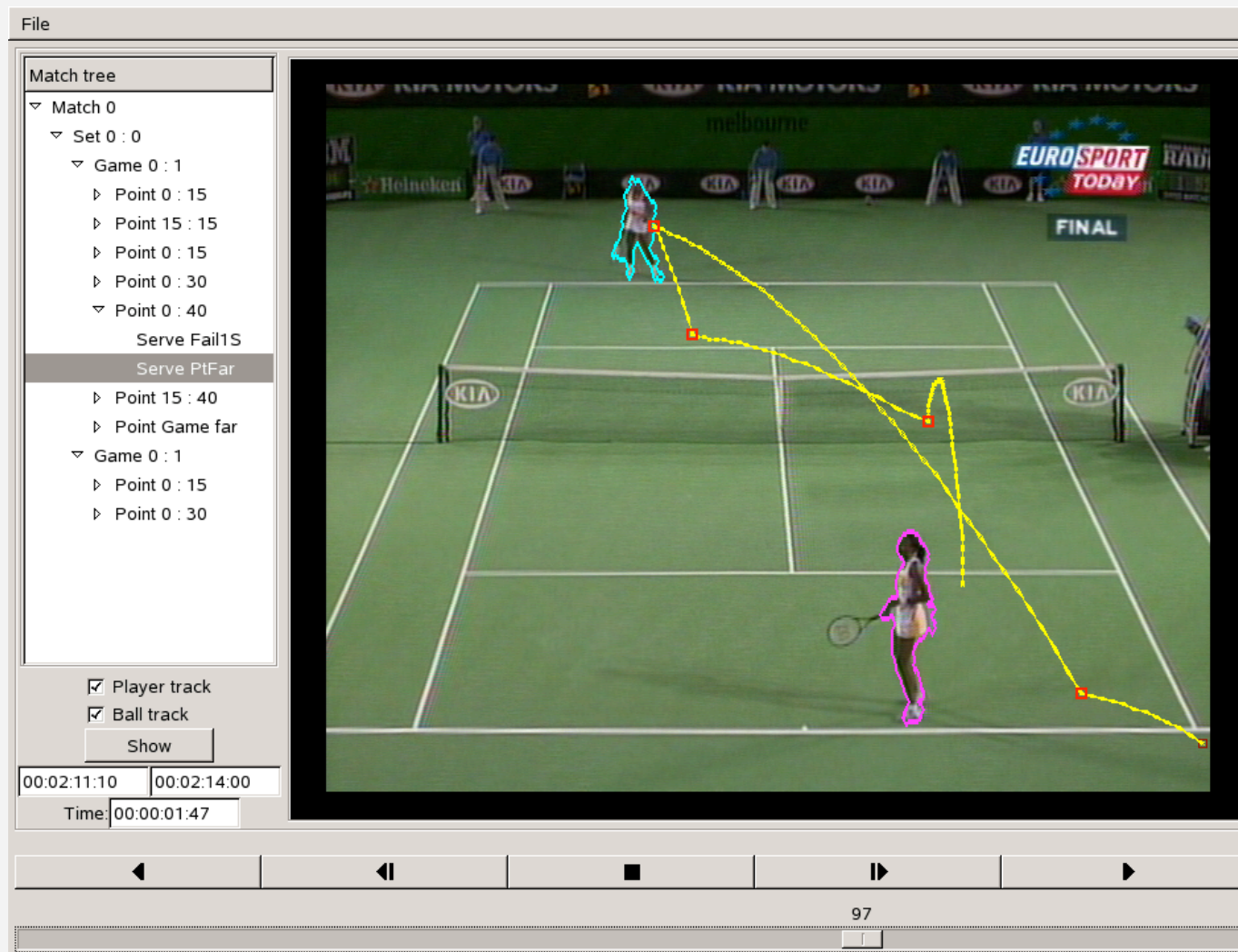
# Cognitive bootstrapping for knowledge transfer in automatic sports video annotation

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# Outline

- Introduction
- Tennis video annotation system for singles
- Mechanisms for system competence extension
  - Incongruence detection
  - Visual event – incongruence association
  - Out-of-play rule adaptation
  - Tennis match evolution model adaptation
- Workplan

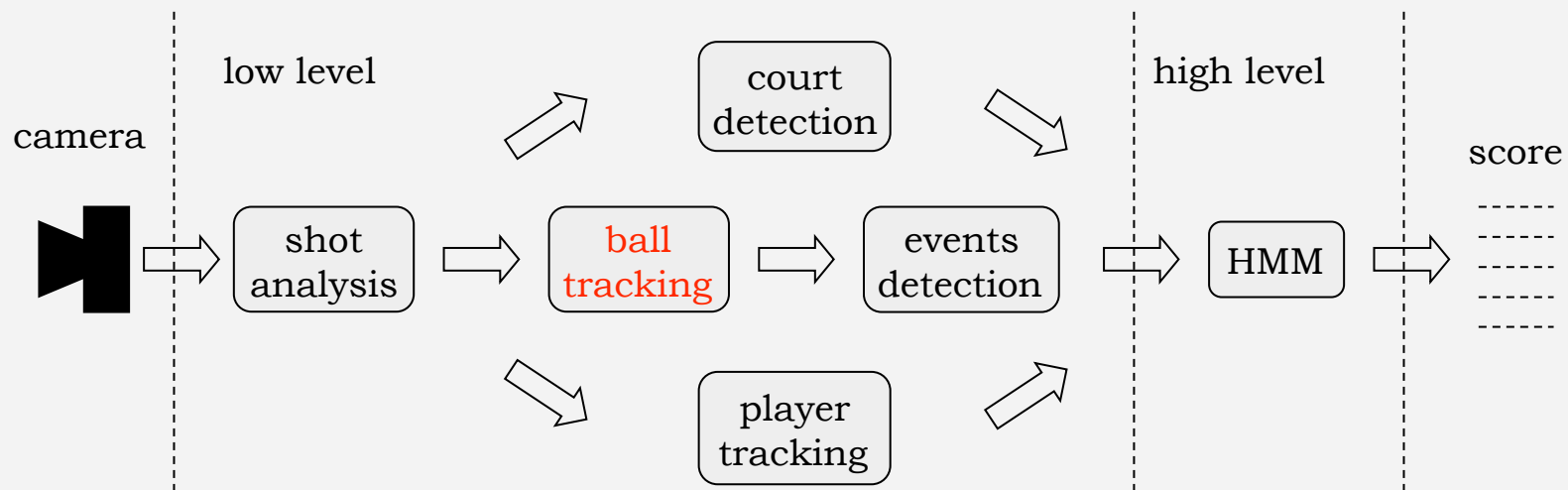
# The tennis annotation system



The screenshot displays a software interface for tennis video analysis. On the left, a 'Match tree' panel shows a hierarchical view of the match: Match 0, Set 0 : 0, Game 0 : 1, and several points. The current point is 'Point 0 : 40', with sub-events 'Serve Fail1S' and 'Serve PtFar' highlighted. Below the tree are checkboxes for 'Player track' and 'Ball track', both checked, and a 'Show' button. A time display shows '00:02:11:10' to '00:02:14:00' and a 'Time:' field set to '00:00:01:47'. The main video window shows a tennis match on a green court with 'melbourne' and 'EUROSPORT TODAY' branding. A player is highlighted with a cyan outline, and the ball's path is shown as a yellow dashed line with red square markers. A pink outline highlights another player in the foreground. At the bottom, there are playback controls (back, stop, play, forward) and a progress bar with the number '97'.

## A tennis annotation system

- A system that “understands” tennis
- In the sense: video in -> score out
- High level reasoning relies on low level processing
- Ball tracking is crucial



# ACASVA objectives

- Existing machine perception systems
  - largely no ability to adapt
  - no ability to extend competence/transfer knowledge
- ACASVA aims to develop mechanisms for cognitive bootstrapping, i.e. ability to
  - adapt detectors
  - transfer knowledge
  - adapt interpretation processes
  - acquire new competences

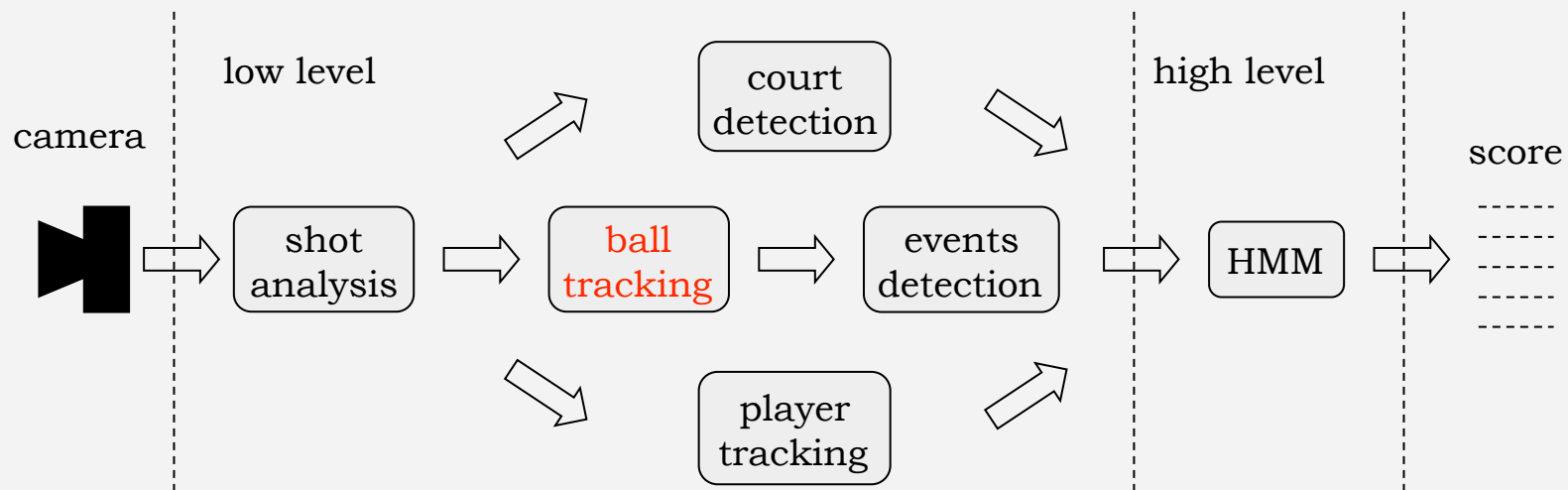
# Bootstrapping tasks

- Varied complexity
  - Variation on the same sport
  - Adaptation to other racket court games
  - Other court games
- Start with the simplest possible task
  - Extending automatic annotation from tennis singles to tennis doubles

- Mechanisms needed for system competence extension
  - Incongruence detection
  - Visual event – incongruence association
  - Out-of-play rule adaptation
  - Tennis match evolution model adaption
  - Context classifier

# Incongruence detection

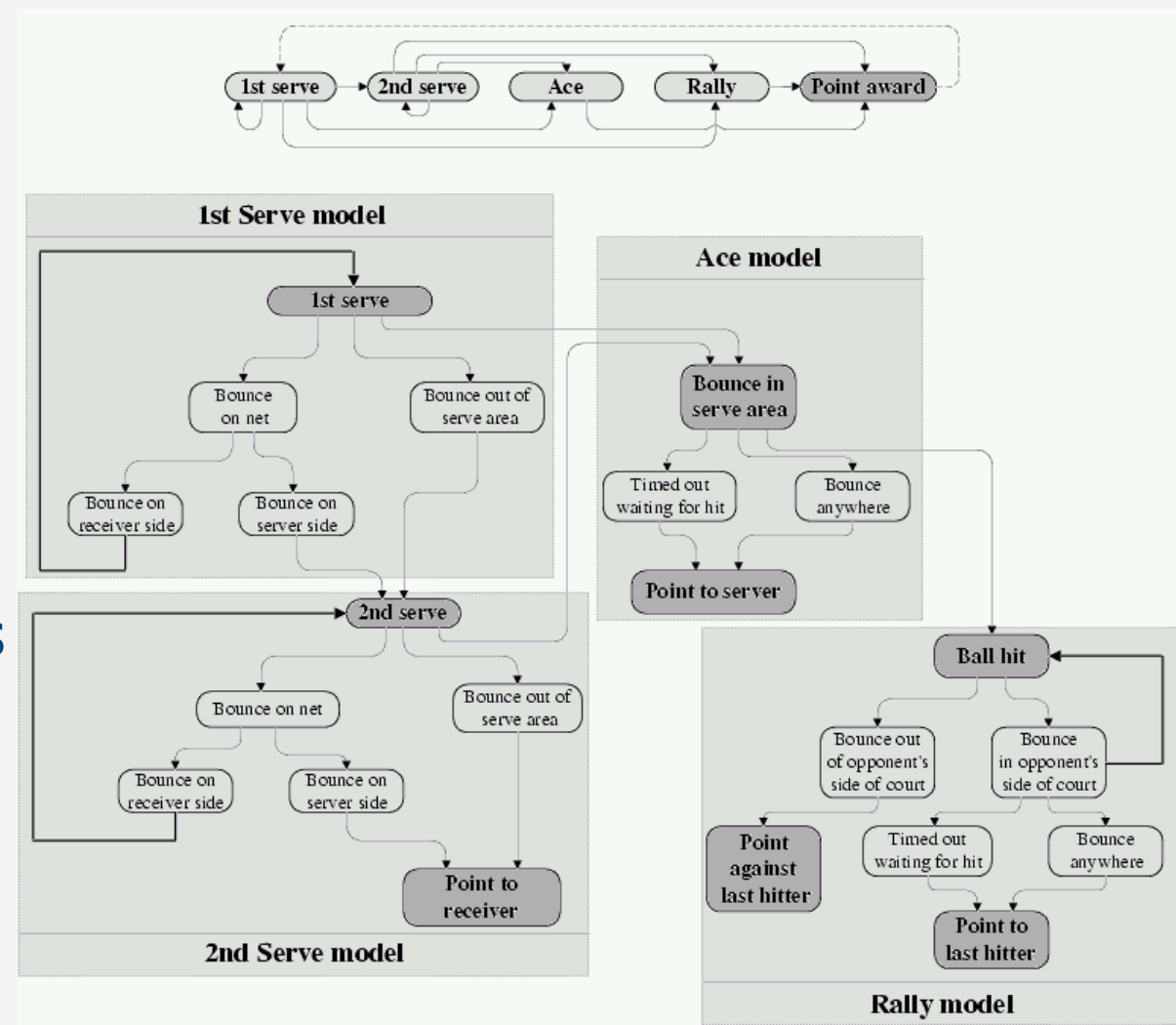
- Detection of unexpected events (outliers, rare)
- Exemplified by out-of-vocabulary word detection in automatic speech recognition
- Based on observed discrepancy between weak and strong (contextual) classifiers





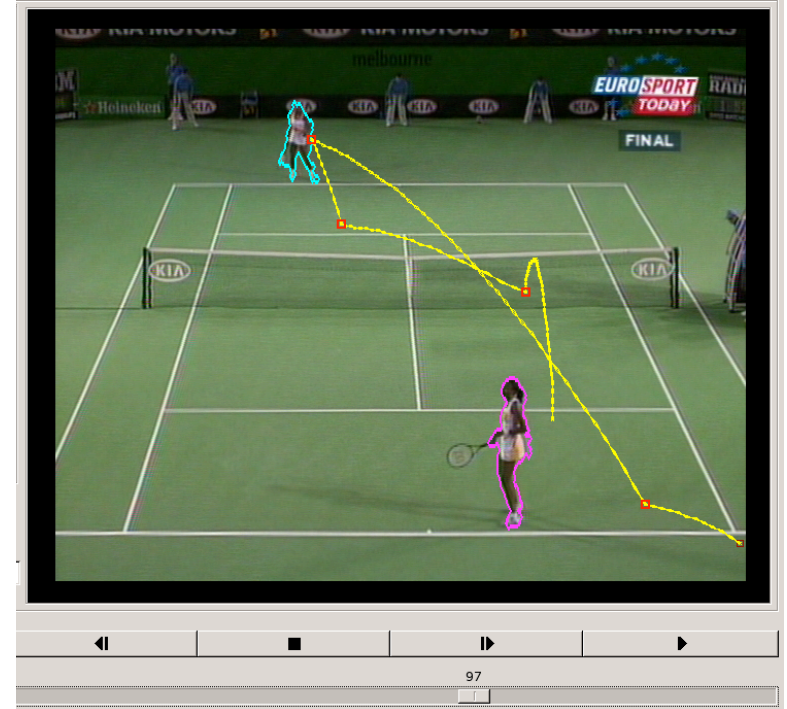
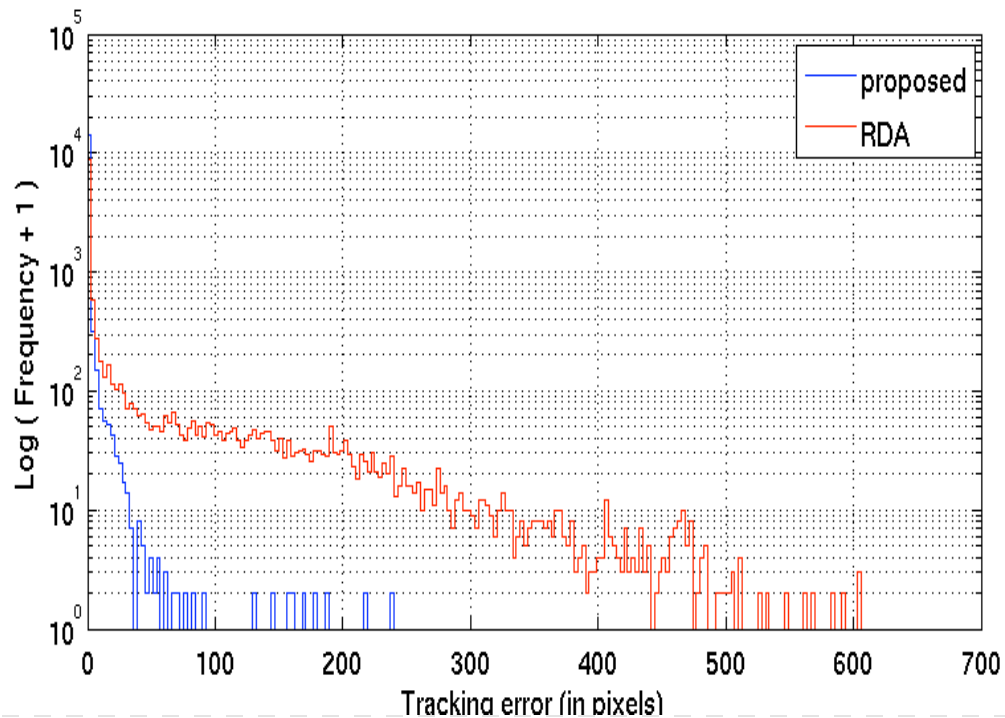
# Match evolution model

- Simplified for ease of training
- Error correcting Viterbi algorithm
- Point awarding model only
- Future extensions to game and set models



# Statistical analysis of percepts

- Histogram of visual events (errors versus a systematic change)
- Visual event – incongruence association
- Scene evolution model adaptation (more players)



# Work programme

- General player detection/tracking module (Teo)
- Incongruence detector (Ibrahim)
- Visual event – incongruence association (Aftab)
- Tennis match evolution model adaptation (Ibrahim)
- Context detector (Teo?)
- Psychology support
  - Bootstrapping mechanisms of human visual perception