Data mining of portable EEG brain wave signals for sports performance analysis:
An Archery case study

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BACKGROUND
- Achievement in high performance sport requires an appropriate 'state of mind', which is trained alongside the physical skills.
- However, quantification of mental state during coaching is often difficult.
- With the advent of a new generation of portable compact EEGs and wireless eye tracking devices, one can measure the neurocognitive activity of an athlete's brain and their visual focus simultaneously in ecologically representative training scenarios.

AIM/OBJECTIVES
- We present evidence suggesting that the 'state of mind' of an athlete can be measured and compared with target-based performance measures.

METHOD
- Measurements were taken from intermediate, county level, near elite and elite archers investigating:
  o quantification of EEG brain wave signals comparing archers of different abilities
  o correlation of EEG data across shots as a function of marksmanship
  o prototyping real-time EEG data feedback using sound during training
  o synchronous EEG and eye tracking
- Archery was chosen to demonstrate the real-time and in-situ quantification of neural activity compared with target-based measures of performance that archery provides, over a range of time-spans and skills.
- Mental performance was explored during stages of a shot, across shots within a set, or across different sessions.

RESULTS
- Results demonstrate that there are significant and measurable changes in EEG patterns during a shot with evidence suggesting that the patterns vary as a function of skill level, but not simply as a function of score.
- Significance of each of these outcomes for goal-directed learning and performance enhancement are discussed.

DISCUSSION
- This may provide coaches and athletes with real-time EEG feedback to identify differing mental skill execution compared to a baseline or aspirational measurement from another athlete.
- Future work includes injury recovery/prevention and welfare, rehabilitation, and work with mobility-challenged non-athletes.