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**UK ICT Pioneers 2011 Competition** 

# **A SMART CAMERA THAT LEARNS FROM ITS ERRORS**

### INTRODUCTION

- Enable machines to understand visual information in order to make decisions.
- There is no decision-making

#### EXPERTS

- The essential problem of long-term tracking is to build an object model.
- It is not possible to design a perfect model, but it is often easy to recognize inconsistencies (errors).



- process that does not make errors.
- Current methods do not make use of their own errors.
- Therefore, we introduced a new ightarrowlearning paradigm that:
  - accepts that every method eventually fails
  - exploits failures to improve the performance



Given a single example of an object, follow it in a video – **long-term tracking**.





This task is simple for a human, but challenging for a computer as the object changes appearance and moves in and out of the view.



- Properties of experts:
  - use independent information
  - may contradict each other
  - may make errors
- The errors are remembered to avoid them in the future.

#### **P-N LEARNING**

• The new learning paradigm has been formalized as a dynamical system.



## MOTIVATION

Long-term tracking is at the core of a number of industrial applications:



- Advantage:
- makes use of inevitable errors
- reflects learning process of a human

#### RESULTS

- A new learning paradigm
- Application to the long-term tracking
- An improvement in robustness and flexibility (outperforms state-of-the-art)
- Opens new application areas (e.g. longterm behaviour analysis)

#### ONLINE

Source code (GPL licence v2.0) Demo application Publications: BMVC'08, ICCV'09 (w), CVPR'10, ICPR'10, ICIP'10 http://cmp.felk.cvut.cz/tld

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