Real Time Video Analysis and Visualisation utilising Computer Game Technologies

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From Newcastle. For the world.

• Games Lab at Newcastle University

- **Dr Gary Ushaw**
- **Senior Lecturer and Director of Business and Engagement for School of Computing**
- **Previously Engineering Manager and Lead Software Developer in games industry**
- Ubisoft, Atari, BBC, Sony, Rockstar
- **Games Lab works with UK Game Industry**
- Nvidia, Rockstar, Sony, Microsoft, Activision, Warner Bros, Sega, Ubisoft, Rebellion, etc

Introduction

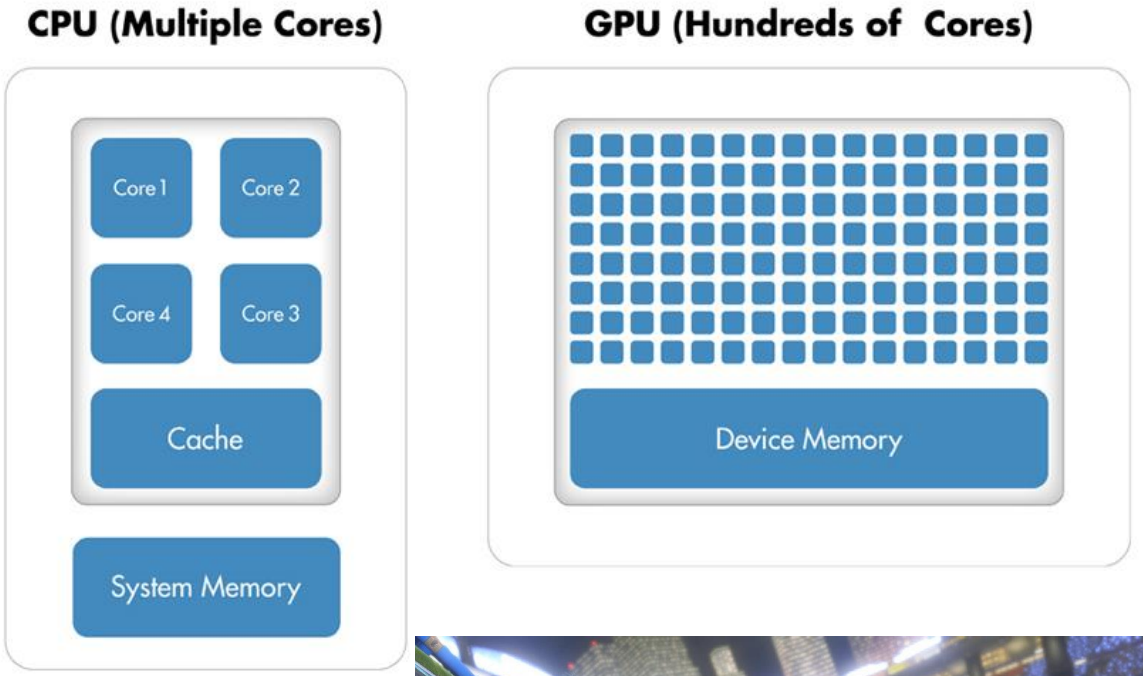
- **Games Lab at Newcastle**
- **What is computer game technology**
  - Real time simulation and evaluation
  - Graphical
  - Interactive
- **Some projects**
- **Summary of our approach**

Newcastle University Games Lab

- **Teaching and Research in Game Engineering**
- MSc course
- PhD students
- Research projects
- **Underlying Engine Technology**
- **Distributed Computing**
- **Real Time Simulation**
- **Real Time Image Processing**
- **Applied Games Technologies**
- Health
- Education
- Engineering
- Commercial

Computer Game Technology

- Interactive
- Real Time
- Commodity hardware
- Accessible
- Processing Time vs Accuracy
- Parallel computing on GPU
- Communal Activity



Pixar: 36 hours per frame

Nintendo: 33 milliseconds per frame

Projects

Health

- Stroke rehabilitation through motion detection
- Upper limb rehabilitation for young children with cerebral palsy
- Stereovision testing
- Addressing metamorphopsia with augmented reality
- Deep fake recognition and face blindness

Engineering

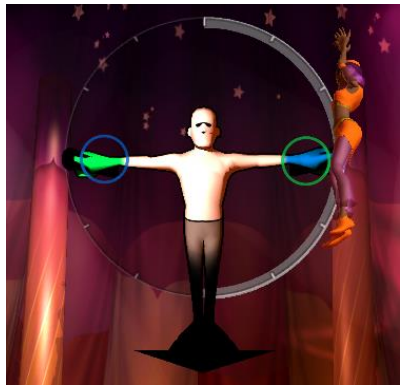
- Real time livestock assessment
- Railway vehicle simulation
- Interactive material deformation

Education

- Global water conservation and management
- Vindolanda and Roman Britain

Project: Stroke rehabilitation

- Circus Challenge game
- Patients repeat stroke rehabilitation exercises in time with characters
- Measures upper limb movement and extension
- Uses magnetic field motion sensors and camera
- Runs on standard PC
- Positive feedback and progress
- Telemetry for medical monitoring

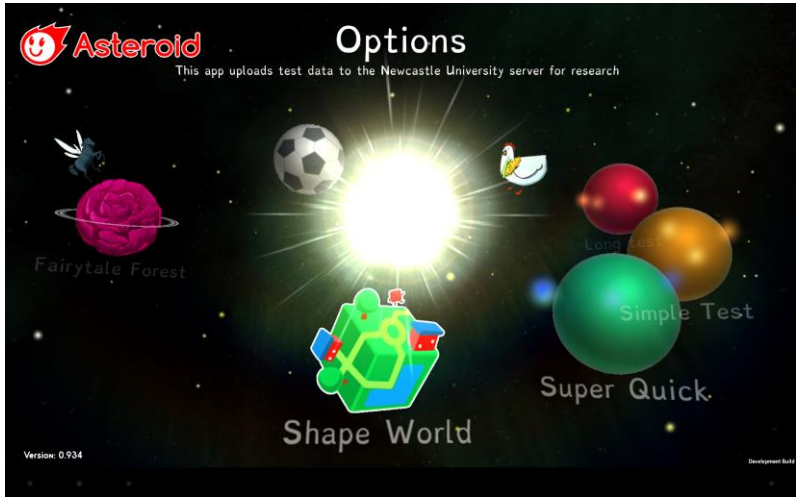


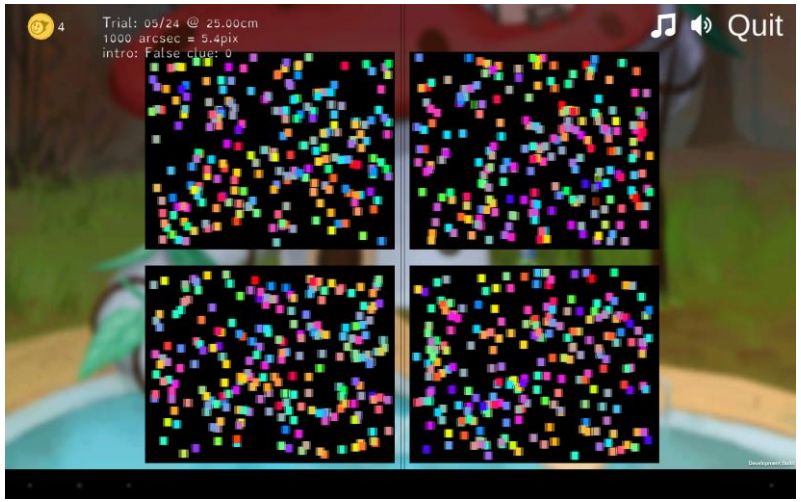
Project: Interactive Storybook for Cerebral Palsy

- **Interactive storybook for young children with cerebral palsy**
- **Runs on standard tablet, uses camera and touchscreen**
- **Recognises rehabilitative hand movements:**
- Pronation and Supination
- Wrist flexion and extension
- Pinch
- Grasp
- **Jamie and Angus by Anne Fine (children's laureate)**

Project: Stereovision Testing

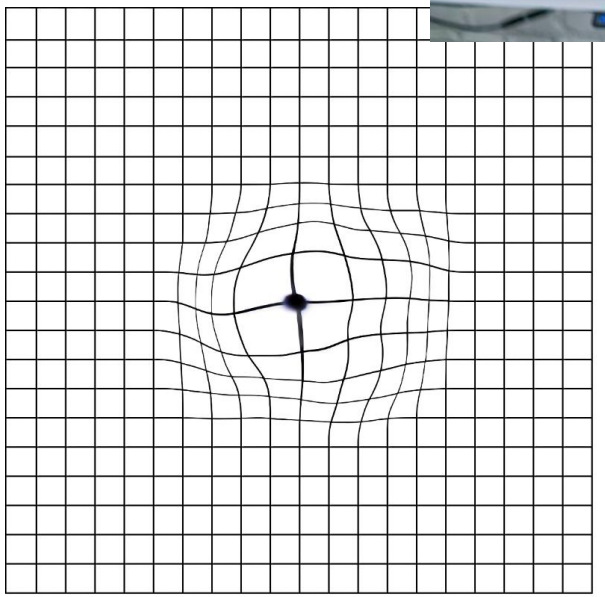
- ASTEROID: Game for testing stereoacuity in children
- Runs on glasses-free 3D tablet in classroom
- Uses inbuilt camera to detect distance to child's eyes
- Macro game loop provides increased accuracy in measurement





Project: Addressing metamorphopsia with augmented reality

- Metamorphopsia is a vision defect with consistent warped image
- Disorder that disrupts the normal orientation of the macular photoreceptors
- Virtual Reality with front facing camera (Vive)
- Augmented Reality on the live image to address the inconsistency
- Interactive application identifies patient's specific defect

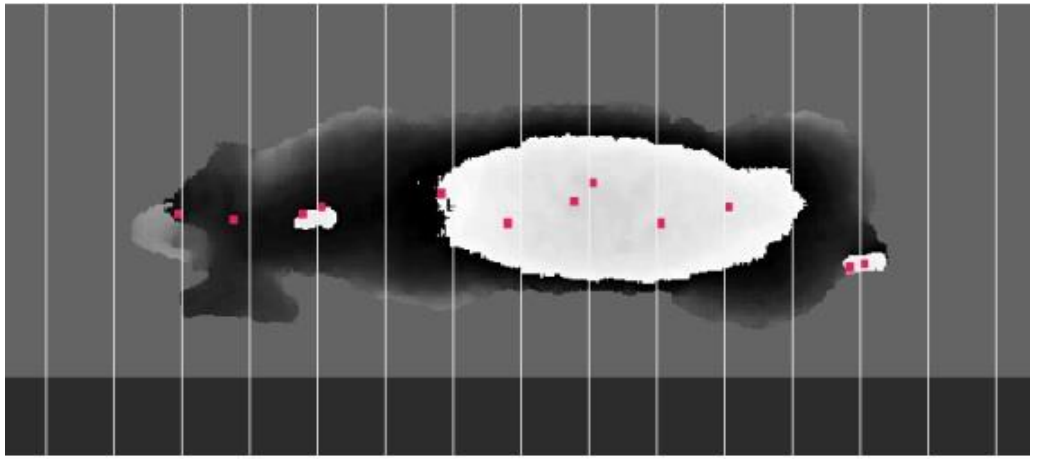


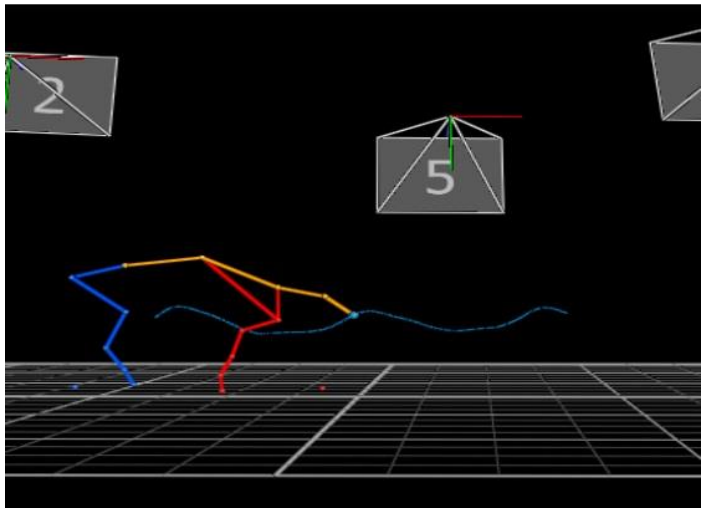
Project: Deep Fake Recognition and Face Blindness

- Prosopagnosia, known as face blindness
- Deep fake detection – facial imagery
- Are the visual cues that detect deep fake faces also useful in addressing prosopagnosia?
- Both image feature and movement contribute

Project: Real Time Livestock Assessment

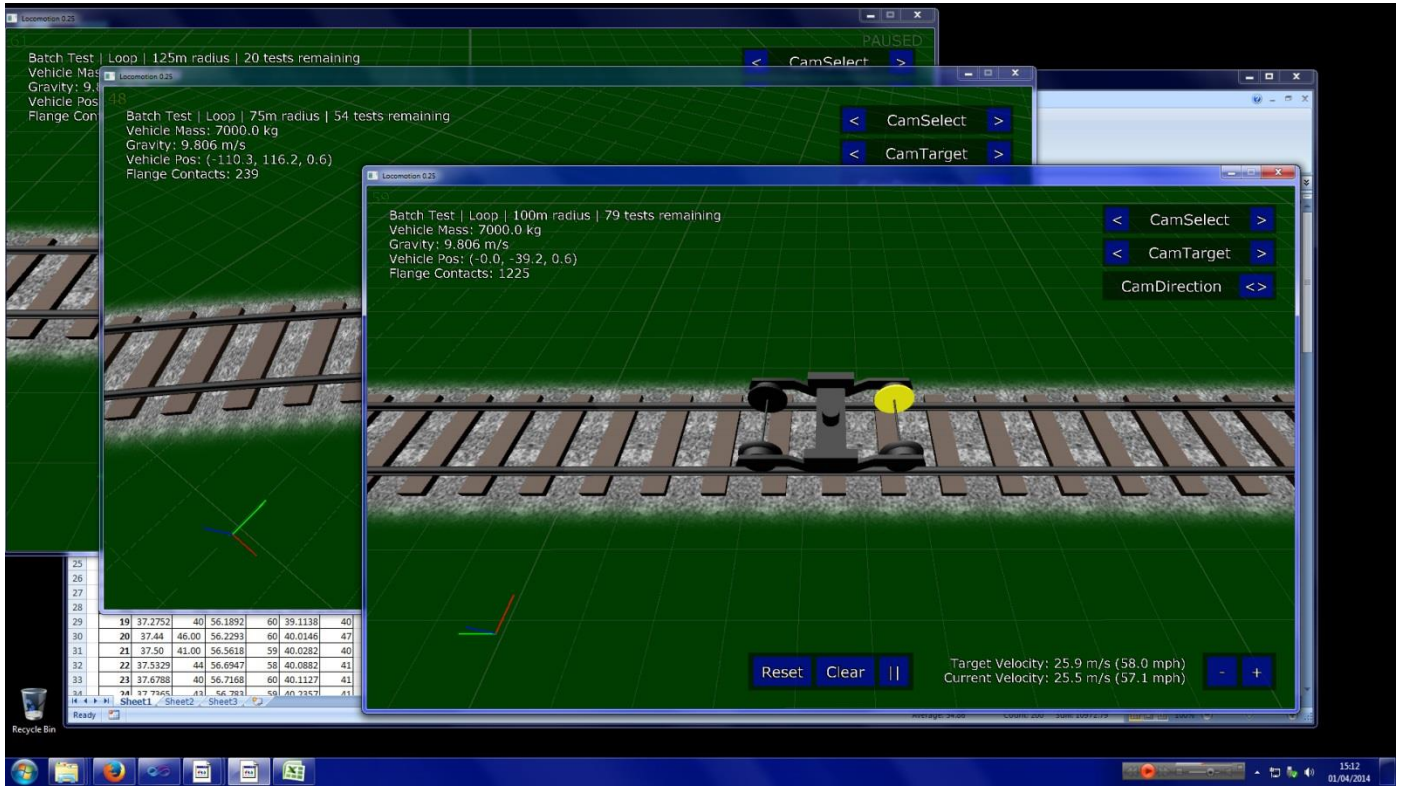
- Commodity hardware (Xbox Kinect)
- Assesses the size and the gait of pigs
- Real time vision analysis
- Automatically direct livestock toward appropriate feed
- Significantly cheaper and as reliable compared to previous solution





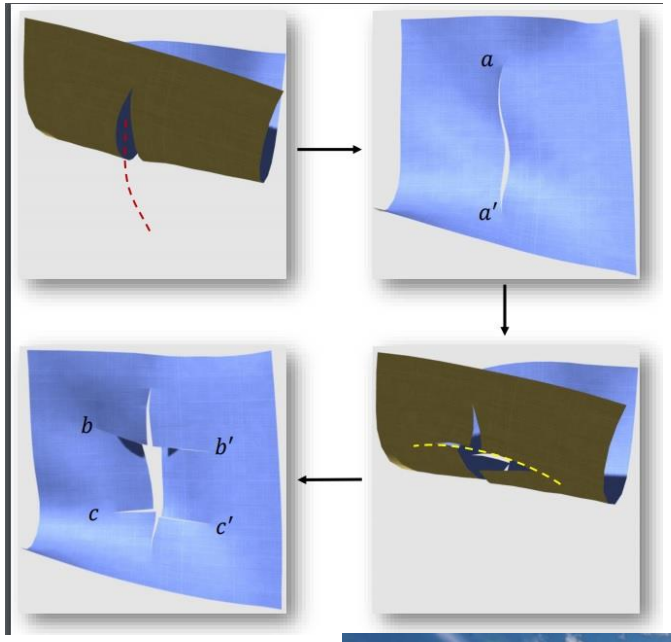
Project: Railway Vehicle Simulation

- Real time simulation, 60 frames per second
- Fast prototyping and feedback
- Speed vs accuracy
- Identify most promising parameters
- Parallel solution of differential equations on GPU



Project: Interactive Material Deformation

- Finite Element Modelling in real time
- Fidelity vs speed of computation
- Buildings constructed from deformable materials
- Modelling of pressure on the structure
- Modelling of tears in the material
- Parallel computation on GPU



Project: Global Water Security

- Educational games
- Teach schoolchildren in developing countries about water pollution, conservation and security
- No text, purely visual feedback
- Learn through doing
- Explore environment and work out how to clean up the river

Project: Roman Britain and Hadrian's Wall

- Educational games
- An on-site murder mystery
- Runs on mobile devices
- Augmented Reality helps immerse the players while exploring the artefacts
- In partnership with Sega Creative Assembly, and Vindolanda Trust

Games Lab at Newcastle

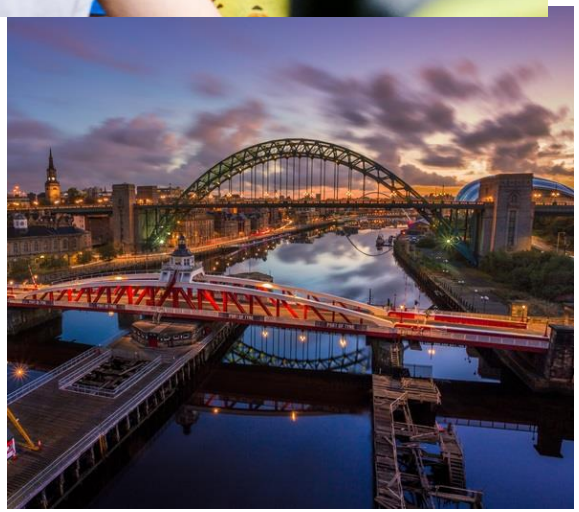
The lab consists of

- 60+ MSc students
- 10 PhD students
- 4 faculty members

MSc projects as demonstrators and prototypes
Grant applications based on prototype work

Work with researchers in other fields

- Medical
- Engineering
- Commercial (eg Nvidia)
- History
- Agriculture
- etc

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Any questions?
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