Motion Capture: Applications, Software, and Challenges

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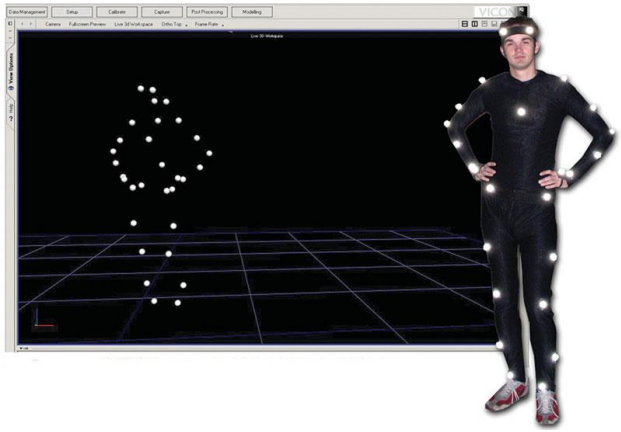

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Outline

- Applications:
  - Computer Animation – iPi Soft, Motive, Captury Studio
  - Simulation – Organic Motion LIVE
  - Sports – MOCAP Analytics
  - Medicine – Organic Motion BioStage
  - Other applications
- Challenges

Computer Animation

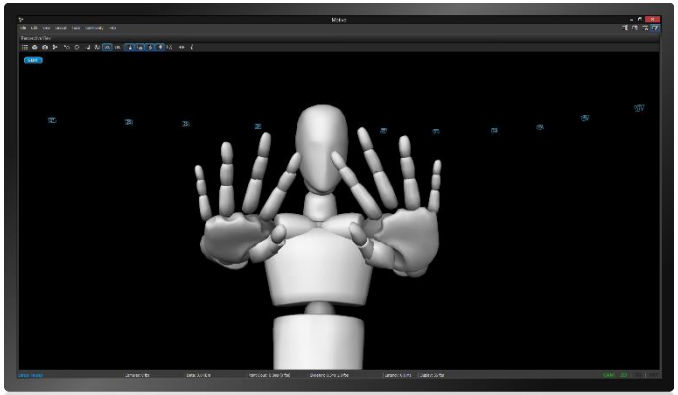
- Computer Animation:
  - Make subject (human) movements in movies and computer games as much realistic as possible
    - Games: Far Cry 4, GTA V
    - Movies: Avatar, The Lord of the Rings
  - Create/generate new motions by merging movements that follow each other

Computer Animation – iPi Soft

- iPi Soft (iPi Soft – Russia)
  - Marker-less motion capture software primarily focused on creation of realistic animations
  - Supports up to 16 cameras or 4 Kinect sensors and maximally three actors
  - Price: 1.2k USD per year

Computer Animation – Motive

- Motive (OptiTrack company – USA)
  - Invasive (marker-based) motion capture software
  - Enables to capture facial expressions
  - Price: 2k USD (+2k USD facial expressions)



Computer Animation – Captury Studio

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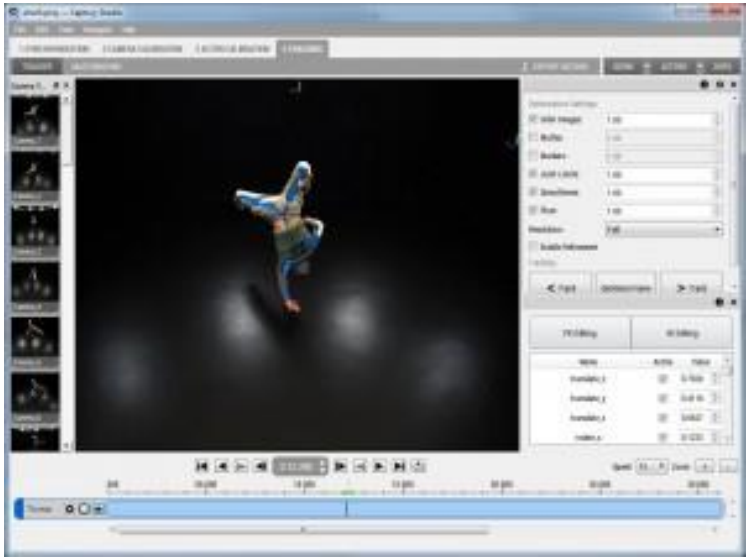
- Captury Studio (MPI company – Germany)
  - Package for offline post-processing an unlimited number of input videos from different camera sources
  - Automatic synchronization of input videos
  - Enables to capture non-human skeletons
  - Price: 5k EUR per year



Simulation

- Simulation:
  - Improve the education and training of military forces or healthcare personnel by inserting live role-players
  - Interact with digitally animated characters in live training scenarios in a natural and intuitive way
  - Organic Motion LIVE (Organic Motion – USA)
    - Marker-less face and body motion tracking software
    - Contains voice modulation software

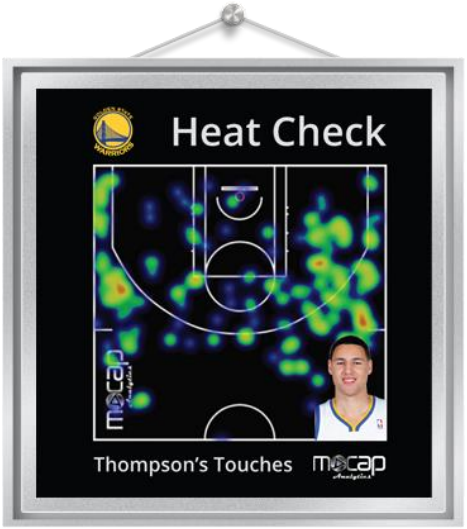
Sports

- Sports:
  - Quantify improvement or loss of performance of athletes
    - Quantify improvement by comparing individuals to themselves rather than a statistical norm which they may not fit
  - Predict injuries and injury location by identifying individual performance degradation over time
  - Recognize talents who fit a given model or scheme

Sports – MOCAP Analytics

DISA 2015

- MOCAP Analytics:
  - Silicon Valley startup (2011) – "Take your mocap data from a big mess to something that is going to win you games and make you money"
  - General framework for analyzing mocap ball-games data
    - Identifying over 600 interactions per minute of gameplay
  - Price: that depends on what you want…



Medicine

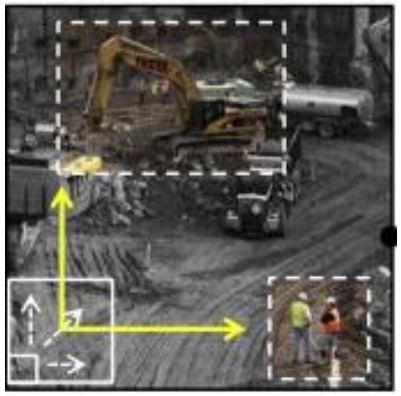
- Objectives:
  - Improve the education and training of healthcare personnel including physicians, paramedics and nurses
  - Create a roadmap to help each patient by showing exactly where and how he or she has gotten better
  - Recognize developmental disabilities and movement disorders such as cerebral palsy, Parkinson's disease, stroke, autism, hyperkinesis, brain/spinal cord injuries and other neuromuscular problems
- Organic Motion BioStage – marker-less technology used to follow the progress of an athlete's recovery from surgery after an injury

Medicine

- Analysis of:
  - Gait, connection between the brain and body motion, and hand-eye coordination
- Research papers:
  - Measure the change in magnitude, speed, and motion similarity of facial animations in head and neck oncology patients, before and after lip split mandibulotomy
  - Monitor loss or regain of control over the virtual pen's movement by touchpad presses of patients with schizophrenia

Other Applications

- Law enforcement:
  - Person identification, event detection
- Safety and health monitoring:
  - At smart homes – detection of falls of elderly people
  - At constructions sites – identification of unsafe acts:
    - Speed limit violations of equipment
    - Close proximity between equipment or equipment and workers



Challenges

- Classification:
  - Goal: assign a query motion to a given category(ies)
  - Usage: action (event) recognition, annotation, subject rec.
  - Ideas: motion as an image classified by a neural network
- Retrieval:
  - Goal: find (sub-)query-similar actions in a long motion
  - Usage: medicine, animation/motion generation
  - Ideas: "ballistic" seg. + motion-words, similarity joins
- Interactions:
  - Goal: find specific interactions (events) among subjects
  - Usage: sport analysis

Questions?

Thank you for your attention.