

Motion Blobs



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Should I Go to the Bathroom Now?

- **Sketch of physics input from 6 players on Kinect**
- **Me, playing with my balls**

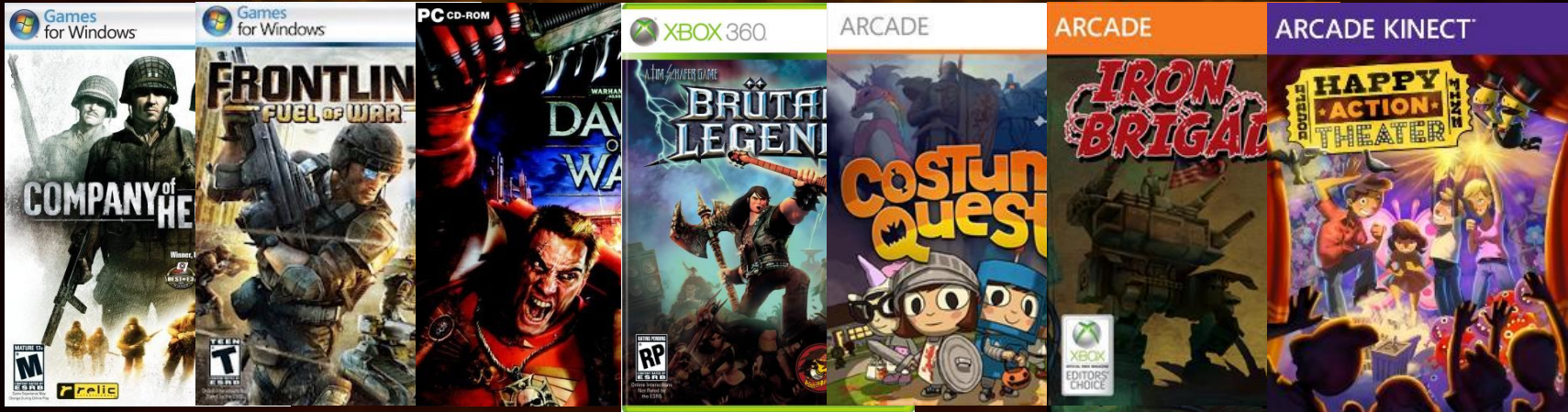


Introduction

- Who am I?



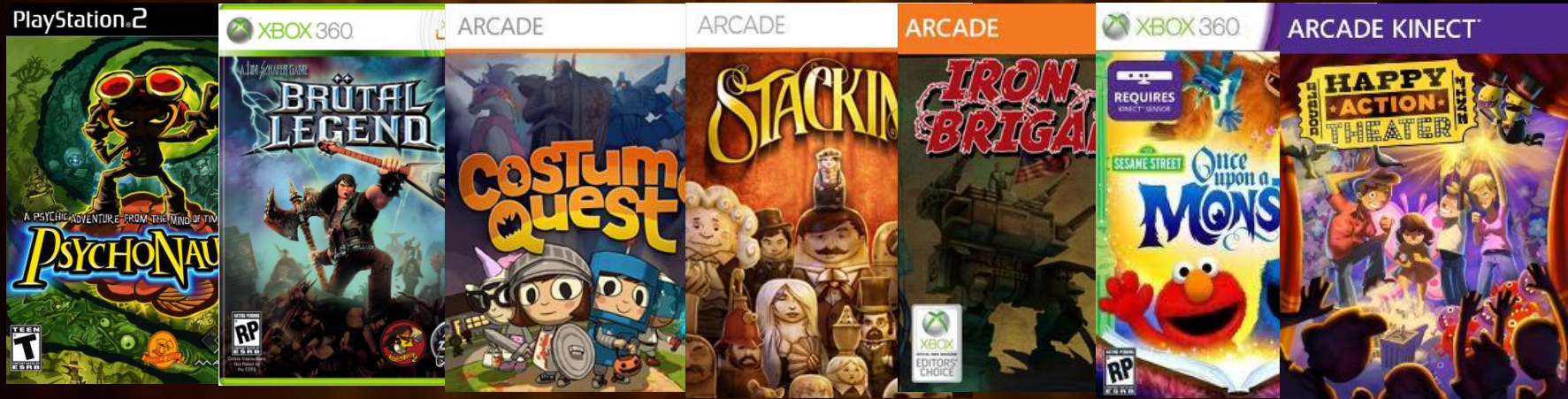
Chris Journey!



Introduction



- **Who is Double Fine**



- **No, I will not buy you lunch**



Introduction

- **What is DFHAT?**



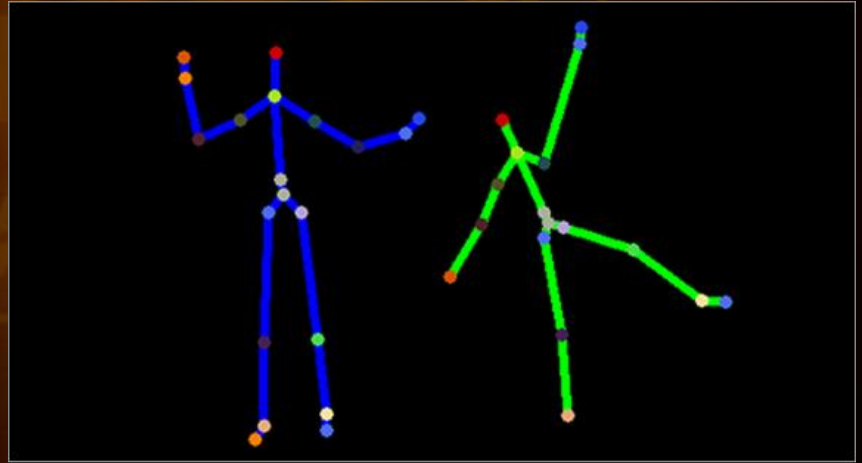
Introduction

- **Gameplay video...**



The Problem

- **Motivation for Motion Blobs**



The Problem

- **Inputs (Kinect buffers)**



Depth



6 Player Indices

The Problem

- **Affecting the game**



The Solution

• Problem with traditional vision solutions

Adaptive and Constrained Algorithms for Inverse Compositional Active Appearance Model Fitting

George Papandreou and Prince Narasimhan
National Technical University of Athens, Greece
<http://comp.vision.ntua.gr/~papandreou/papers/>

1. Objective
- Improve robustness of AAM fitting under big appearance variation, as in face AAMs learned on multiple persons.
- Reduce the influence of the inverse compositional approach in image fitting and video tracking.

2. Active Appearance Models
- Parameters: shape & texture models, $g = \{g^s, g^t\}$

3. Incremental AAM fitting
- Define the image -> forward, additive only:
$$I_{k+1} = I_k + \Delta I_k$$

- Define the template -> inverse compositional:
$$I_k = I_{k-1} - \Delta I_{k-1}$$

- Localized fast updates (L2-norms):
$$\Delta I_k = I_k - \hat{I}_k \rightarrow \Delta I_k(I_k)$$

- Most elements of ΔI_k solution can be pre-computed in the IC approach, see last approach.

4. Adaptation I: Matrix Adjustment
- Inverse compositional update:
$$I_k = I_{k-1} - \Delta I_{k-1} \rightarrow I_k = I_{k-1} - \Delta I_{k-1}$$

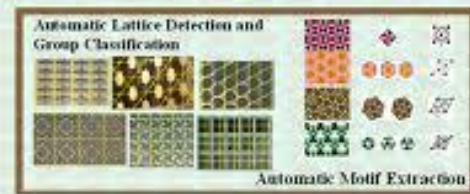
- 1. adaptive: $I_k = I_{k-1} - \Delta I_{k-1}$
- 2. robust template: $I_k = I_{k-1} - \Delta I_{k-1}$
- 3. variable order matrix adjustment:
$$I_k = I_{k-1} - \Delta I_{k-1} \rightarrow I_k = I_{k-1} - \Delta I_{k-1}$$

- 4. IC fitting algorithm:
$$I_k = I_{k-1} - \Delta I_{k-1} \rightarrow I_k = I_{k-1} - \Delta I_{k-1}$$

5. Constrained Search
- Use prior information in AAM fitting:
$$I_k = I_{k-1} - \Delta I_{k-1} \rightarrow I_k = I_{k-1} - \Delta I_{k-1}$$

- Gradient search: $I_k = I_{k-1} - \Delta I_{k-1} \rightarrow I_k = I_{k-1} - \Delta I_{k-1}$
- Gradient search: $I_k = I_{k-1} - \Delta I_{k-1} \rightarrow I_k = I_{k-1} - \Delta I_{k-1}$
- Gradient search: $I_k = I_{k-1} - \Delta I_{k-1} \rightarrow I_k = I_{k-1} - \Delta I_{k-1}$

6. Experimental Evaluation
- AAM fitting on static images (MUTS database)



The Solution

- **Hacks to the rescue!**



Processing

- 1) Calculate motion**
- 2) Filter motion**
- c) Label image**
- 4) Correlate labels over time to create blobs**
- V) Create game inputs from blobs**



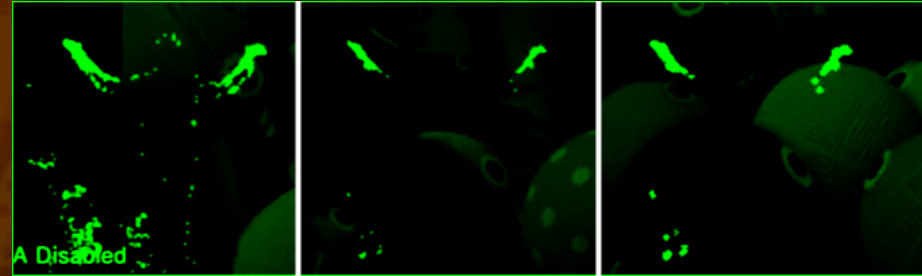
Calculate Motion

- **Compare to previous frame**
- **Accept pixels new to the player & player pixels with significant Z change**



Filter Motion

- **Blob shrink**
 - **Clear noninterior pixels**
 - **Eliminates noise**
- **Blob grow x 2**
 - **Set pixels touching edge**
 - **Merges slightly disconnected areas**



Filter Motion



Motion

Shrunk

Grown x 2

Label Image

- **For every untouched motion pixel**
 - **Flood to all touching cells, setting the label**
 - **Calculate a 3D center of mass**



Motion & Label Video



Correlate Labels

- **Find new labels to match all the old labels**
- **Biggest old blobs first**
- **Axes of comparison:**
 - **Player index**
 - **Center of mass vs. predicted position**
 - **Cell count**



Correlate Labels

- **If a match is found, update the blob**
 - Smooth out motion
 - Smooth out size
- **If a match is not found, ZOMBIE BLOB**
 - Extrapolate motion
- **Kill off old zombies**



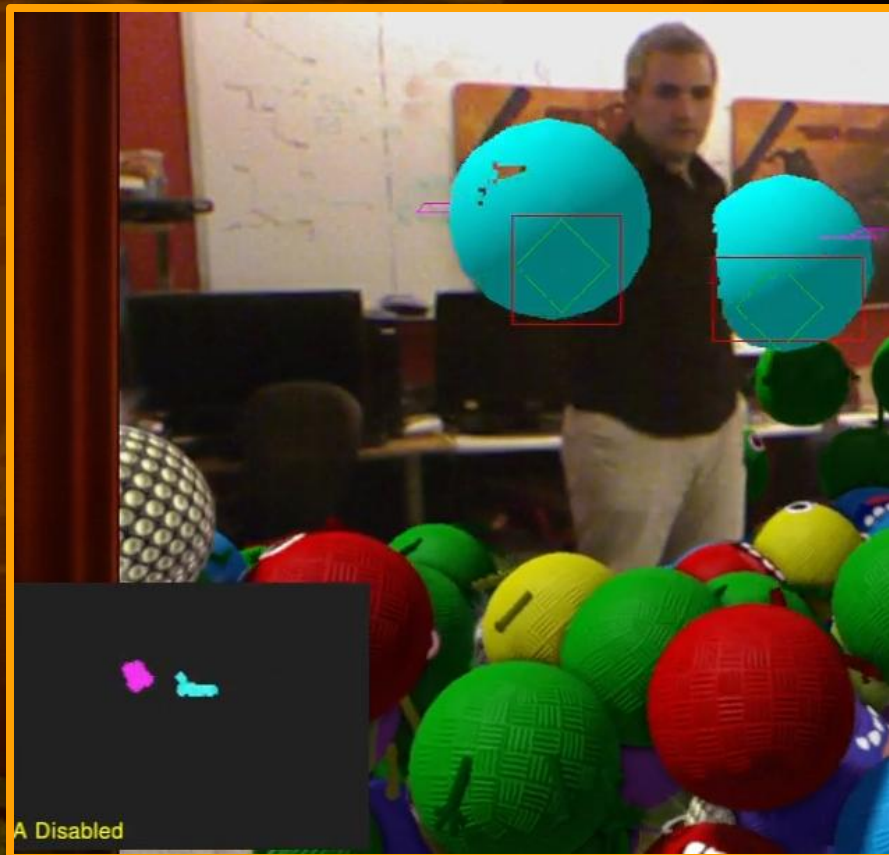
Correlate Labels

- **Make new blobs for remaining big labels**



Gameplay Effects

- **Convert blobs to collision spheres**
- **Size is based on blob area**
- **Center is 3d center of mass**
- **Calculate gestures from history**



Blob Debug Video



Pros

- **Efficient to calculate**
- **Quick to implement**
- **Action correlated to motion**
- **Efficient collision representation with velocities**



Cons

- **Only useful for crude gestures**
- **Collision generated is innacurate**



Payoff Video



Motion Blobs



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