15-464 / 15-664
Technical Animation

Course Introduction

Hi!

Nancy Pollard

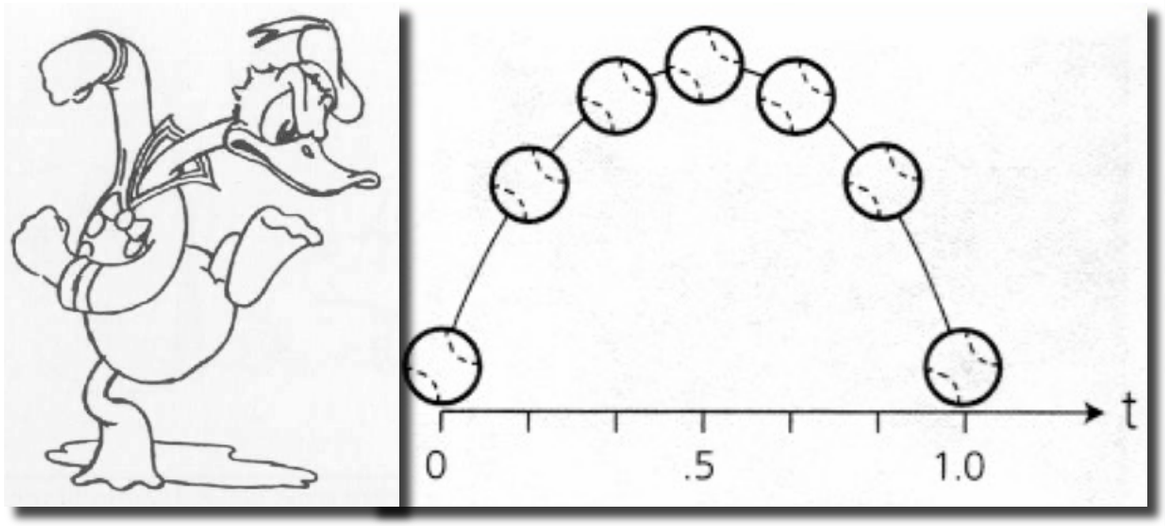
Arjun Lakshmipathy

Let's kick things off with a survey

- https://cmu.ca1.qualtrics.com/jfe/form/SV_7amfDla3LRPBPw2

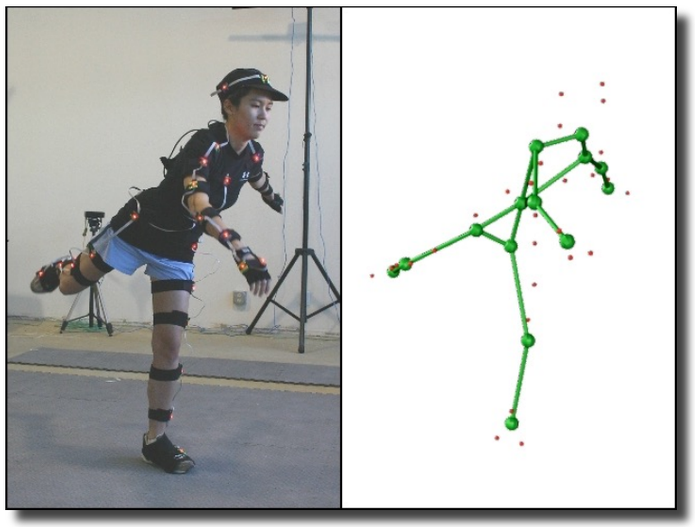
What is this course about?

Techniques for Creating Animation

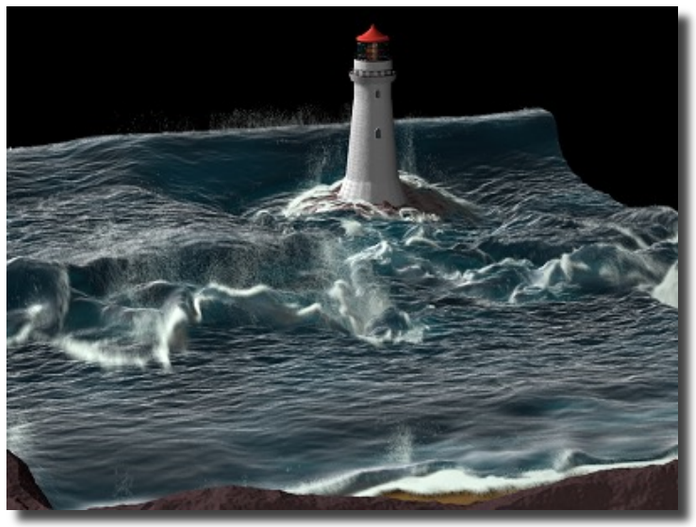


Keyframing

Procedural Animation



Data-driven Animation



Physical Simulation

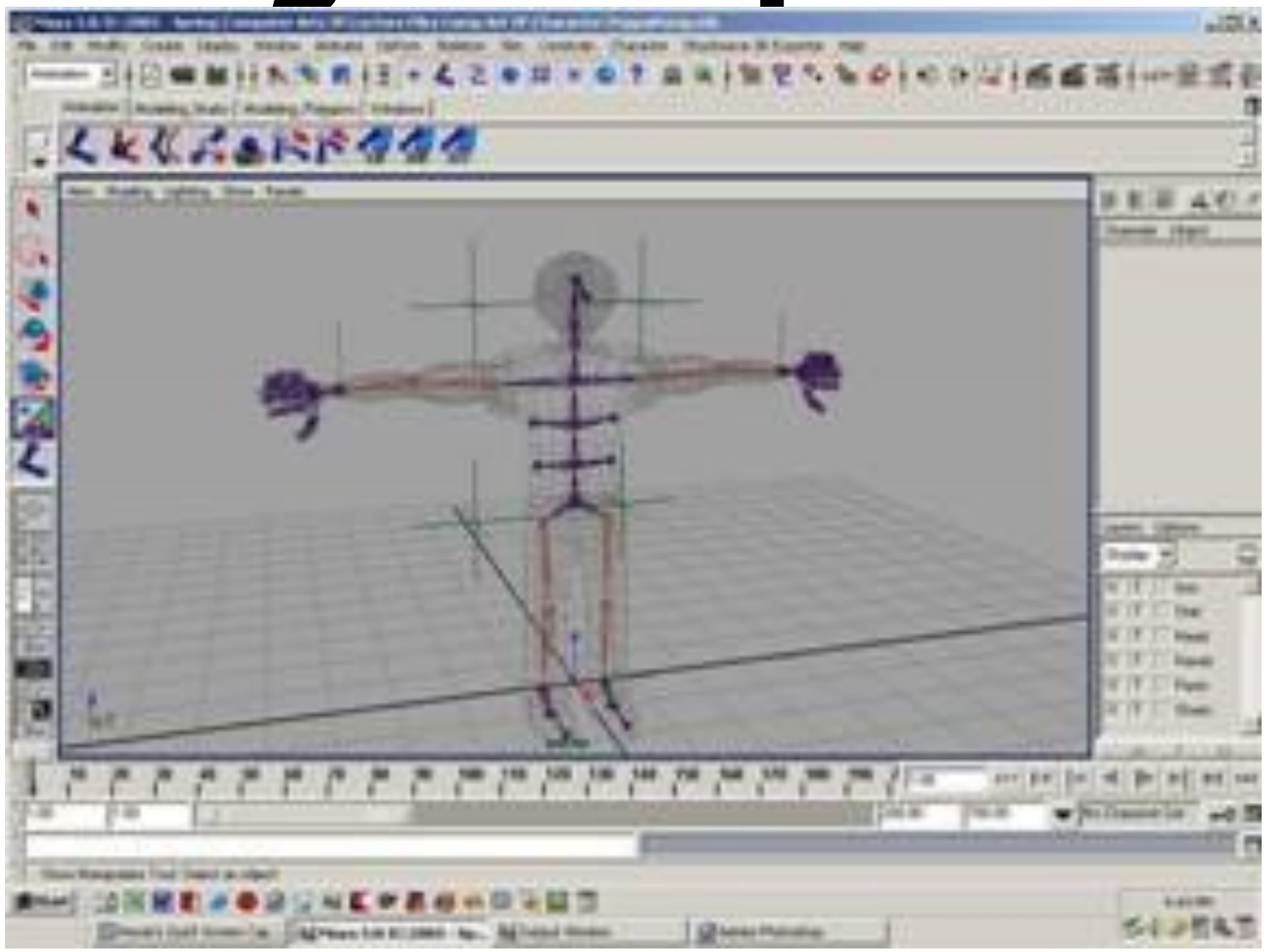
Keyframing: animation

A basic walk cycle tutorial:

https://design.tutsplus.com/tutorials/animation-for-beginners-how-to-animate-a-character-walking--cms-25536

3D Keyframing: setup

Model, rig, and animate your character in Maya



https://www.lynda.com/course-tutorials/Rig-character-from-scratch-Maya/282268l/2314174-4.html

http://cgi.tutsplus.com/tutorials/creating-and-rigging-a-non-deformable-wooden-character-in-maya-part-1--cg-25436

http://www.youtube.com/watch?v=rWKLPDfamm0

Keyframing = Traditional Animation

Snow White

https://www.youtube.com/watch?v=1TtQ-CTMlEI

Toy Story

https://www.youtube.com/watch?v=wmiIUN-7qhE

Keyframing = Traditional Animation?

BoxTrolls

Stop Motion

Isle of Dogs

Kubo and the two strings

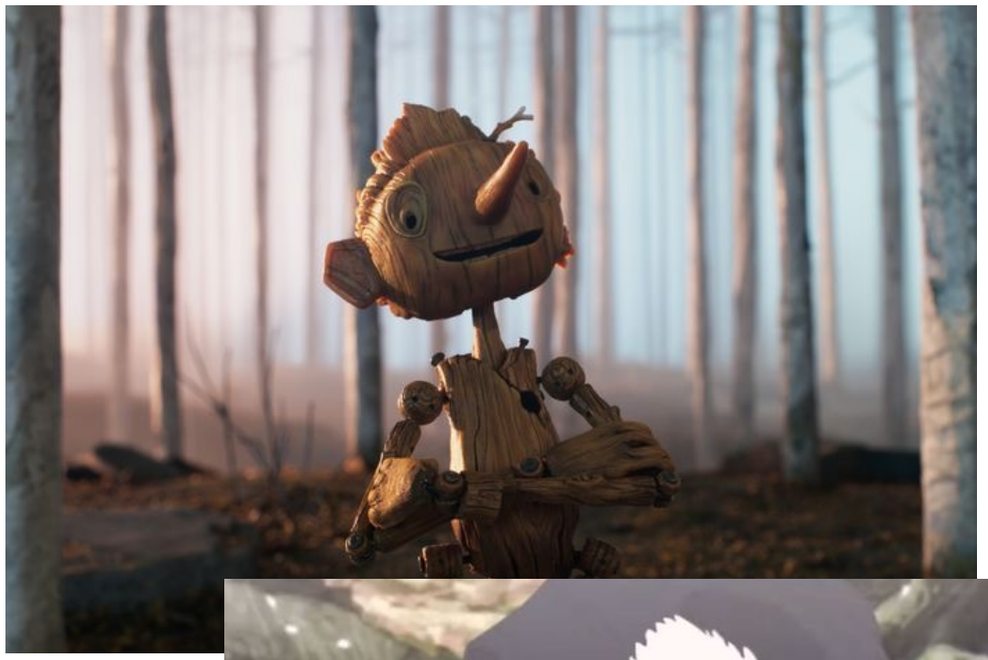
https://www.youtube.com/watch?v=xCBOiaJEoFw
https://www.youtube.com/watch?v=Vhpq7-c911A

3D Animation

Coco and cloth simulation

https://www.youtube.com/watch?v=NCAuK_gBStE&feature=emb_logo

Keyframing = Traditional Animation?



https://www.vulture.com/article/best-animated-movies-2022.html

Principles of Traditional Animation
[Lasseter, SIGGRAPH 1987]

- Stylistic conventions followed by Disney's animators and others

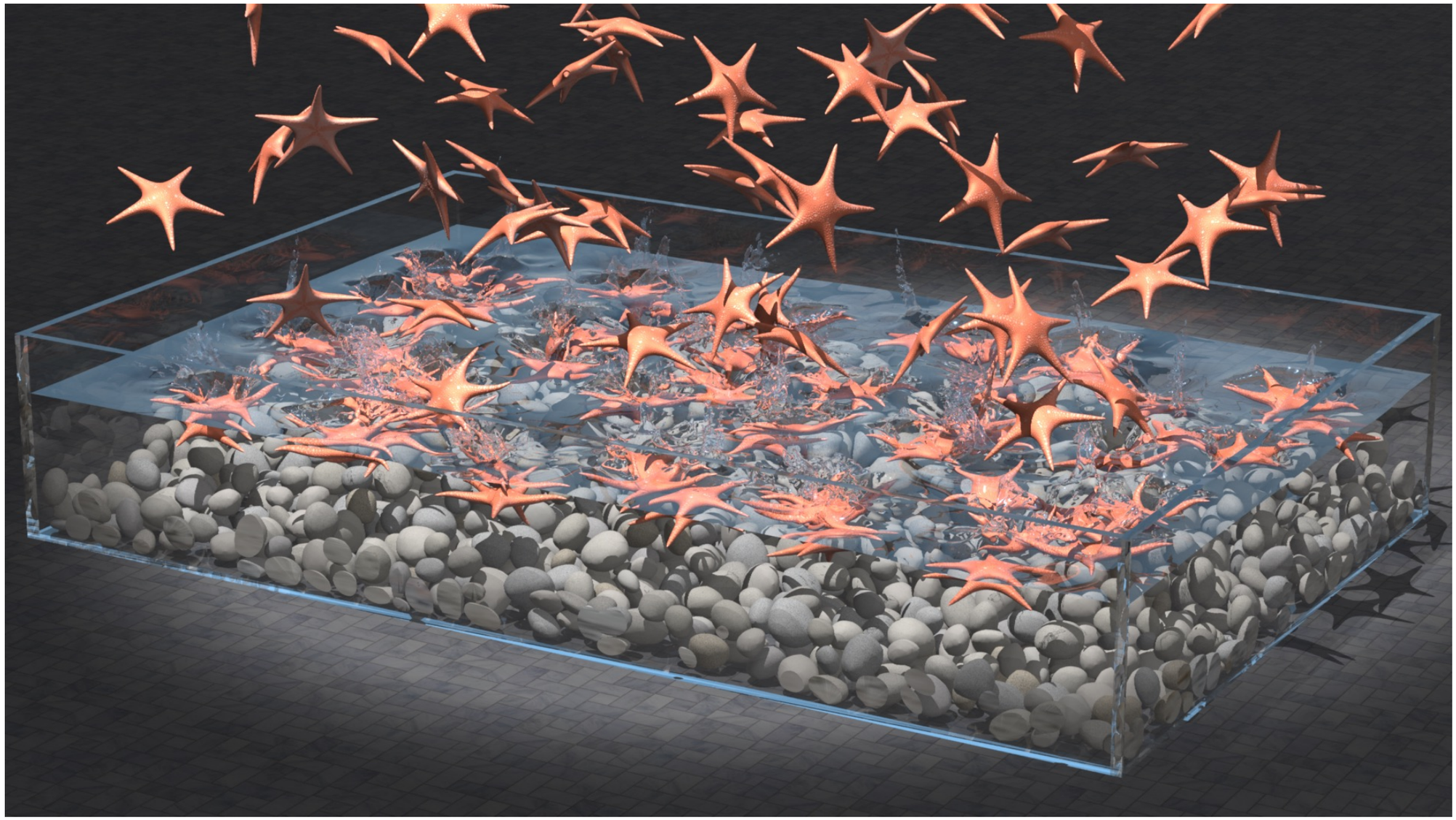
- From experience built up over many years
  - Squash and stretch -- use distortions to convey flexibility
  - Timing -- speed conveys mass, personality
  - Anticipation -- prepare the audience for an action
  - Followthrough and overlapping action -- continuity with next action
  - Slow in and out -- speed of transitions conveys subtleties
  - Arcs -- motion is usually curved
  - Exaggeration -- emphasize emotional content
  - Secondary Action -- motion occurring as a consequence
  - Appeal -- audience must enjoy watching it

Procedural Animation

http://www.massivesoftware.com/

http://www.animationboss.net/behind-scenes-marvels-black-panther-vfx/

Physics-based Animation



http://physbam.stanford.edu/~fedkiw/

Data-driven Animation

http://graphics.cs.cmu.edu/

Motion Capture Lab

Wean 1334

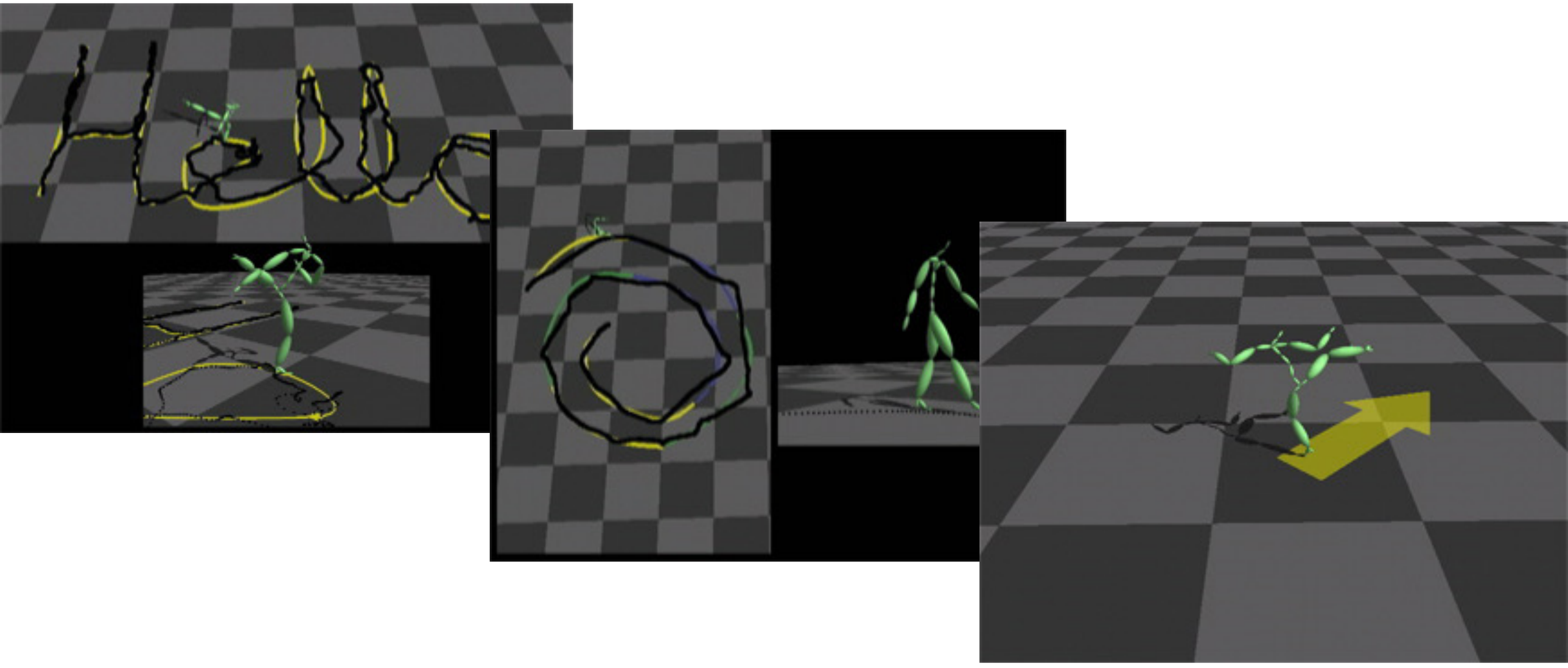
https://www.youtube.com/watch?v=1rbgZNBGA1g

http://graphics.cs.cmu.edu/

We can capture an individual performance

https://www.youtube.com/watch?v=P2_vB7zx_SQ

What about creating autonomous or responsive characters? Motion Graphs (2002)



http://www.cs.wisc.edu/graphics/Gallery/kovar.vol/MoGraphs/

Lucas Kovar (U.Wisconsin / ILM)
with Michael Gleicher

What about creating autonomous or responsive characters? Learning (2020)

Character Controllers using Motion VAEs

HUNG YU LING, University of British Columbia, Canada
FABIO ZINNO, Electronic Arts Vancouver, Canada
GEORGE CHENG, Electronic Arts Vancouver, Canada
MICHIEL VAN DE PANNE, University of British Columbia, Canada

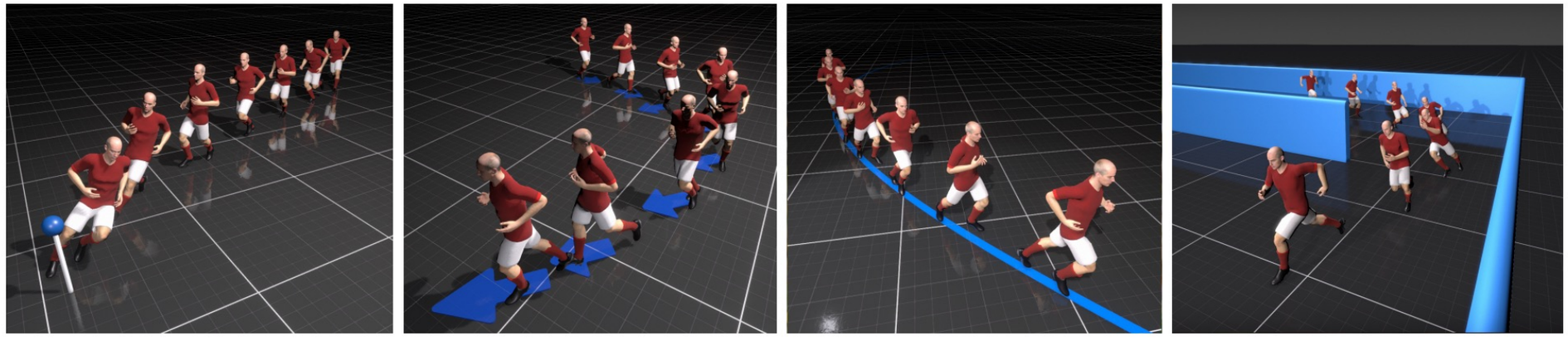


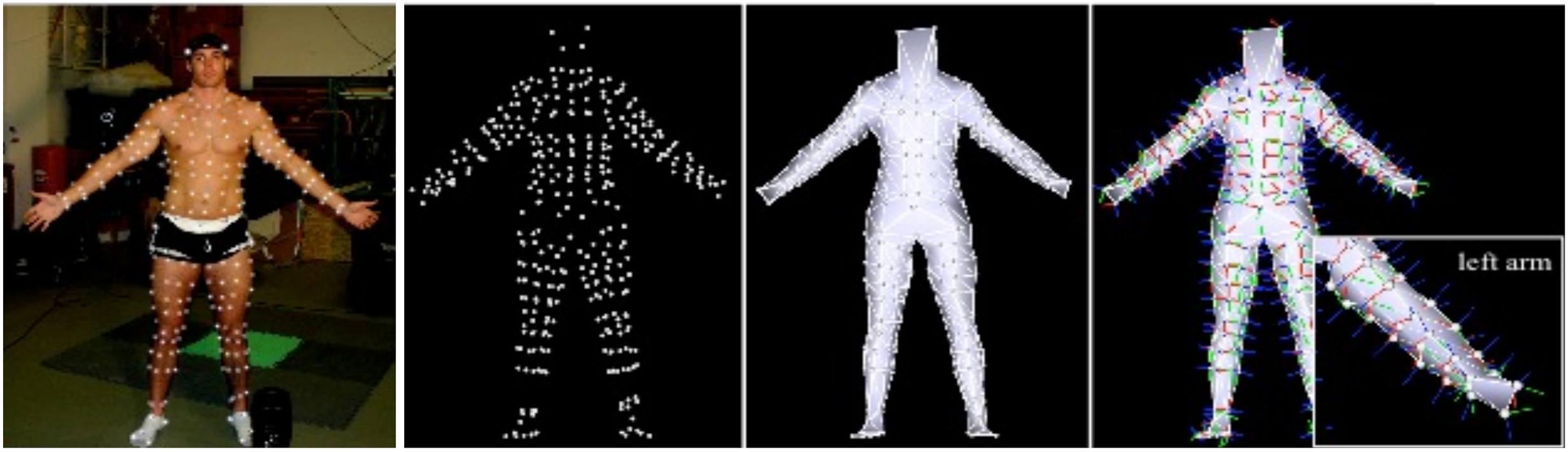
Fig. 1. Given example data, we learn an autoregressive conditional variational autoencoder that predicts the next pose one frame at a time. A variety of task-specific control policies can then be learned on top of this model.

https://www.cs.ubc.ca/~hyuling/projects/mvae/

Dense Body Capture

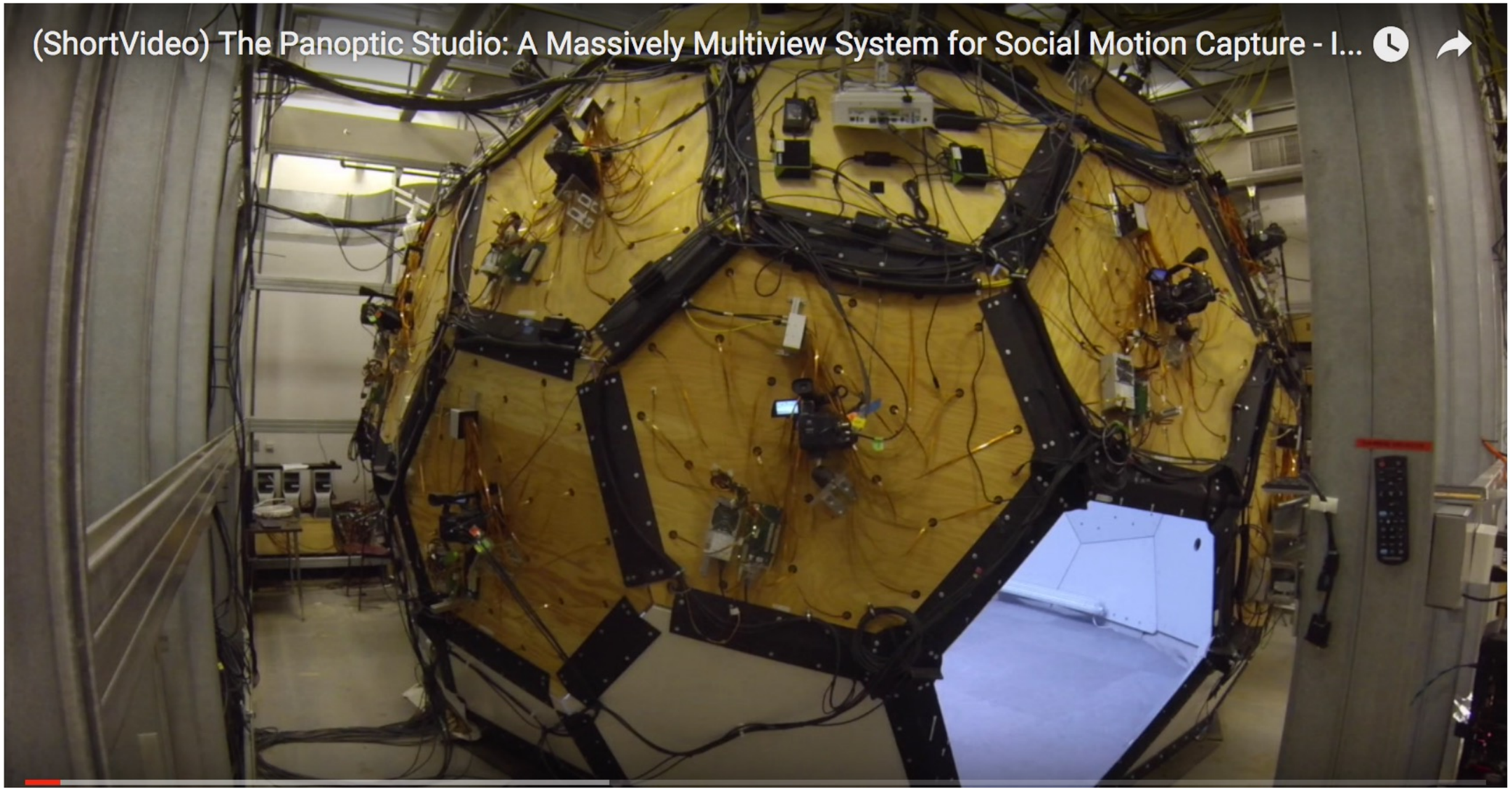
Laser Range Scanning

Dense Marker Capture



Sang Il Park (CMU / Sejong University)
with Jessica Hodgins

Panoptic Studio (CMU)



https://www.cs.cmu.edu/~hanbyulj/panoptic-studio/

https://www.youtube.com/watch?v=yzAtedDYLrc

Performance Capture from Video

DeepCap: Monocular Human Performance Capture Using Weak Supervision

Marc Habermann[1,2] Weipeng Xu[1,2] Michael Zollhoefer[3] Gerard Pons-Moll[1,2] Christian Theobalt[1,2]

[1]Max Planck Institute for Informatics, [2]Saarland Informatics Campus, [3]Stanford University

Abstract

Human performance capture is a highly important computer vision problem with many applications in movie production and virtual/augmented reality. Many previous performance capture approaches either required expensive multi-view setups or did not recover dense space-time coherent geometry with frame-to-frame correspondences. We propose a novel deep learning approach for monocular dense human performance capture. Our method is trained in a weakly supervised manner based on multi-view supervision completely removing the need for training data with 3D ground truth annotations. The network architecture is based on two separate networks that disentangle the task

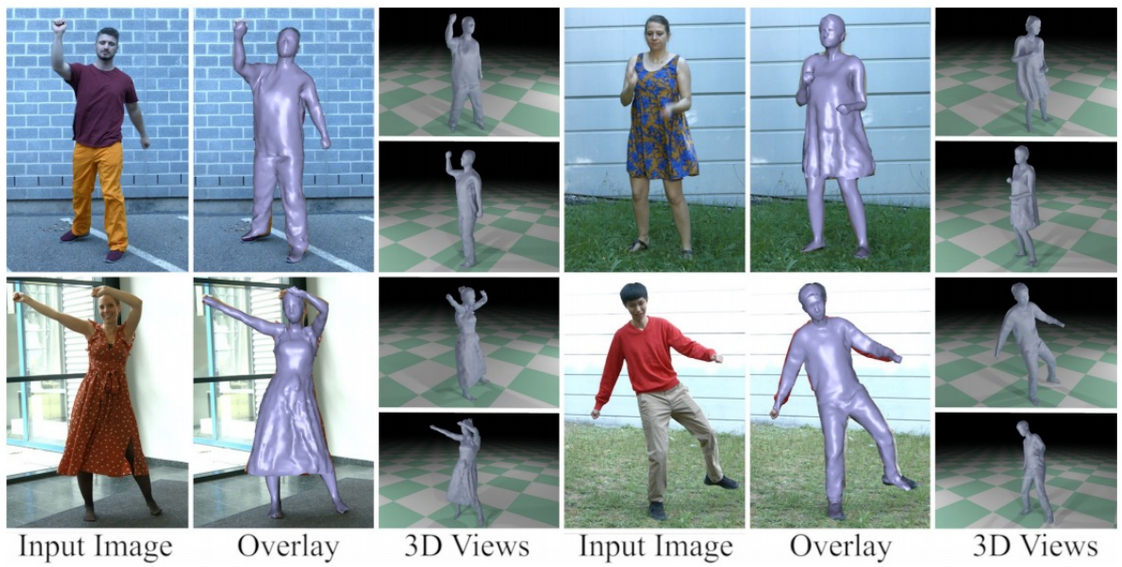


Figure 1. We present the first learning-based approach for dense monocular human performance capture using weak multi-view supervision that not only predicts the pose but also the space-time coherent non-rigid deformations of the model surface.

https://people.mpi-inf.mpg.de/~mhaberma/projects/2020-cvpr-deepcap/

In this class, you will gain hands-on experience with all of these techniques!

Course logistics

15-464 / 15-664 Syllabus for Spring 2023

This is a tentative syllabus and will be adjusted according to results from Assignment 0 and in-class discussion.

Week of	Mon	Weds
Jan 16	**MLK Day NO CLASS**	**Introduction / Course Overview** • Assignment 0 OUT
Jan 23	**Introduction to Animation**	**Motion Capture** • Assignment 0 DUE
Jan 30	**Inverse Kinematics**	**More IK**
Feb 6	**Rigging and Skinning**	**Paper Presentations I**
Feb 13	**MiniProject1 Presentations**	**Simulation and Cloth**
Feb 20	**More Cloth**	**Rigid Bodies and Contact**
Feb 27	**Paper Presentations II**	**Final Project Brainstorming**
Mar 6	**SPRING BREAK**	**SPRING BREAK**
Mar 13	**Final Project Pitches**	**Final Project Pitches**

Course logistics

- Programming Assignments:
  - Mini Project 1 - Traditional Anim (15%)
  - Mini Project 2 - Simulation (15%)

- Final Project 40%

- In-class paper presentation 10%

- Web page / blog 10%
- Class Participation 10%

Assignment 0

Email me your top 5 paper picks by next Wednesday

Prefer published in 2022

Related to Technical Animation

You will give a 10 minute in-class presentation on one of these papers (typically your first choice)

Blog

Please create a blog link and send it to me

Expectation: one paragraph per class period

Not a summary – your thoughts / reactions!