Techniques for Creating Animation

Keyframing

Data-driven Animation

Procedural Animation

Physical Simulation
Keyframing: animation

A basic walk cycle tutorial:

http://www.anticz.com/Walks.htm
3D Keyframing: setup

Model, rig, and animate your character in Maya


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

Stop Motion
Boxtrolls
Kubo and the two strings
https://www.youtube.com/watch?v=Vhpq7-c911A

Big Hero 6 – 3D modeling, animation, and rendering pipeline

https://www.youtube.com/watch?v=y6yrHkZVGf8
Keyframing = Traditional Animation?

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://video.wired.com/watch/design-fx-world-war-z-building-a-better-zombie-effects-exclusive

http://www.massivesoftware.com/
Physics-based Animation

A scalable Schur-complement fluids solver for heterogeneous compute platforms

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(with audio)
Part 1: Technical Description
Data-driven Animation

http://graphics.cs.cmu.edu/
Motion Capture Lab
Wean 1334

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? Deep Learning (2016)

A Deep Learning Framework for Character Motion Synthesis and Editing

Daniel Holden*
University of Edinburgh

Jun Saito†
Marza Animation Planet

Taku Komura‡
University of Edinburgh

Figure 1: Our framework allows the animator to synthesize character movements automatically from given trajectories.

https://www.youtube.com/watch?v=urf-AAIwNYk
Dense Body Capture

Laser Range Scanning
Dense Marker Capture

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

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

https://www.youtube.com/watch?v=wb32z_xwk0c
Performance Capture from Sparse Multi-view Video

de Aguiar et al
Keyframing vs. Motion Capture
Keyframing: setup

What is accomplished?

• Define joint locations and bone heirarchy using a point and click interface

• Define joint limits

• Set up Inverse Kinematics handles

• Bind skeleton to its “skin”
Walk Cycle Variations

Working with Motion Capture is Quite Different...

http://mocap.cs.cmu.edu/
CMU Mocap Database

To define a motion, we need:

The skeleton file: ASF format
The motion file: AMC format

Let’s look at these...
Editing Motion Capture Data

How might you edit motions in such a format?

Retiming

Displacement curves

Motion “filtering”

Keyframe extraction / edit keyframes
Displacement Curves

Main ideas:
• User edits \(\rightarrow\) displacements to the original motion
• Displacements can be made at different resolutions in a hierarchical scheme

Main idea:
• A simple filter applied to a motion sequence can create squash and stretch effects and cartoon like exaggeration.
Keyframe Extraction

Main idea:
- Keyframes are local extrema of an embedding of the motion into a low-dimensional space

Jackie Assa, Yaron Caspi, and Daniel Cohen-Or
Action Synopsis: Pose Selection and Illustration
SIGGRAPH 2005