Techniques for Creating Animation

Keyframing

Data-driven Animation

Procedural 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


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://www.massivesoftware.com/

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

http://physbam.stanford.edu/~fedkiw/
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? Learning (2018)

Interactive Character Animation by Learning Multi-Objective Control

Kyungho Lee¹ Seyoung Lee¹ Jehee Lee¹

¹ Seoul National University

Recurrent neural network learned basketball rules and skills for interactive character animation.

http://mrl.snu.ac.kr/research/ProjectMultiObjectiveControl/index.htm
Dense Body Capture

Laser Range Scanning
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

Motion Filtering

Main idea:

- A simple filter applied to a motion sequence can create squash and stretch effects and cartoon-like exaggeration

The Cartoon Animation Filter
Jue Wang, Steve Drucker, Maneesh Agrawala, Michael Cohen
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