Dranimate: Rapid real-time gestural rigging and control of animation

Ali Momeni and Zach Rispoli
Carnegie Mellon University
5000 Forbes Avenue, Pittsburgh, PA 15213
momeni@cmu.edu, zjrispol@andrew.cmu.edu

ABSTRACT

Dranimate is an interactive animation system that allows users to rapidly and intuitively rig and control animations based on a still image or drawing, using hand gestures. Dranimate combines two complementary methods of shape manipulation: bone-joint-based physics simulation, and the as-rigid-as-possible deformation algorithm. Dranimate also introduces a number of designed interactions that focus the users attention on the animated content, as opposed to computer keyboard or mouse.

Author Keywords
Animation, gestural control, puppetry

ACM Classification Keywords
H.5.1 Animations; H.5.2 User-centered Design; I.3.6 Interaction techniques;

INTRODUCTION

In traditional linear animation, the animator is responsible for devising and designing the intelligence and behavioral modeling of the animated character. This process is often collaboratively accomplished by a team of writers, designers and artists and requires a high level of expertise. In interactive animation, much of the intelligence and behavior modeling is moved out of the animation team's head and performed by a machine [4]. Contemporary applications of interactive animation include motion-capture driven animation, physically based animation, live speech driven lip-sync, among others. Common among these approaches to animation is the integration of an external control system that computationally controls animated elements based on motion capture data and/or simulated physics. While interactive systems are extensively used in the motion graphics, game design and special effects industries, it also offers significant advantages in making complex animation processes available to a much wider audience.

Dranimate is an interactive animation system that allows novice users to create complex animations by starting with a single still image (e.g. photo, drawing, etc.) and using gesture to systematically deform this still image in real-time. Dranimate implements a mixed-shape deformation algorithm that combines as-rigid-as-possible [2] with a skeletal join system animation engine ([1], [5], [3]). More importantly, Dranimate integrates a series of designed user interactions into the creation and real-time control of animated puppets that render the creation and control of an animated character intuitive and rapid.

IMPLEMENTATION

Hardware Design

Our system employs a laptop with custom software, coupled with a camera for capturing live image feeds and a Leap Motion controller for extracting hand poses. Figure 1 shows the overview of the hardware design:

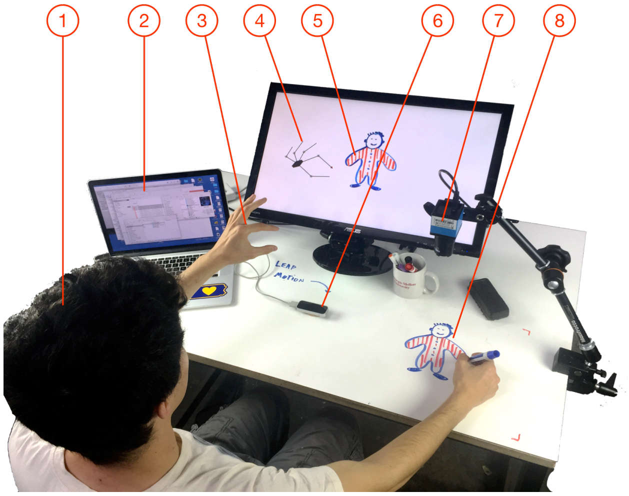

Figure 1. Hardware Overview: 1) User, 2) Laptop, 3) Gesturing hand, 4) Visualization of gesturing hand, 5) animated puppet from live drawing, 6) Leap Motion Controller, 7) Firewire Camera, 8) Drawing

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Software Design

The Dranimate software is implemented in C++ using *openFrameworks*[1], an open source C++ toolkit for creative coding. This environment allows developers to effectively integrate efficient generative graphics with graphical user interfaces and gestural control from an external hardware sensor. The *openFrameworks* environment supports a growing list of *addons*[2] that offer additional functionality. In Dranimate, we employ the following addons: *ofxButterfly* and *ofxTriangleMesh* (mesh generation, ofxCV (machine vision), *ofxLeapMotion* and ofxLeapMotionGestures (gestural control), *ofxClickDownMenu* (GUI) and *ofxPuppet* (animation).

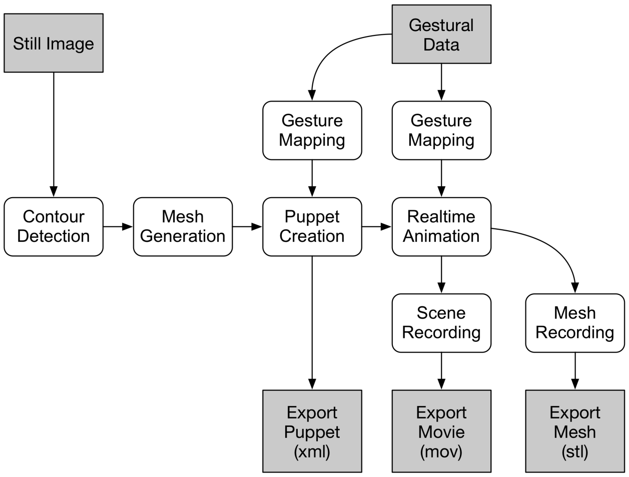

Figure 2. Software Architecture block diagram: Gray blocks at the top and bottom of the diagram represent inputs to and outputs from the system; white inside blocks represent software modules within Dranimate

APPLICATION

Our demo includes six applications represented in separate sections of the video. These applications are described below.

Still Image to animation

This application demonstrates the workflow for creating an animated figure from a still image. The source image is processed by a contour detector and passed to an automatic triangular mesh generator. The user then defines a number of expressive zones that serve as control points for the as-rigid-as-possible shape deformation engine.

Gestural control of animation

This application demonstrates the user interaction in creating and controlling a puppet gesturally. First, the user defines a series of expressive zones and assigns each to a specific finger by pointing to a mesh vertex with the left index finger, and wiggling the desired control finger on the right hand. The user then calibrates the gesture recognition by holding the right hand in a desired starting pose that will correspond with the non-deformed state of the still image. Subsequent changes in the right hand's pose animate the still image in real-time.

Drawing to Gesturally-Controlled Animation

This application demonstrates the complete workflow for starting with a drawing and creating a gesturally controlled animated character.

Complex Scene Composition

This application demonstrates the recording and layering capabilities of the Dranimate application through the incremental composition of a complex animated scene. This rapid process is executed collaboratively by an artist who draws, and a puppeteer who sequentially rigs and animates a recorded palindrome loop for each.

Collaborative Puppeteering

This application demonstrates a collaborative drawing and puppeteering scenario where two users work together to create a gesturally controlled animated dance. Each user draws a figure and rigs it using our gestural control interface.

Dranimate at Life-Scale

This application demonstrates a scenario where the projected animation as well as the interface for real-time control function at life scale. In this example, we utilize a Microsoft Kinect in place of the Leap Motion controller in order to extract body-scale gestural information.

CONCLUSION

Dranimate exploits a range of software, hardware and interaction designs to render the creation of gesturally controlled animated characters easy, fast and intuitive. In addition to obvious applications within animation and special effects, we propose that this approach to intuitive real-time animation holds promise within education, storytelling, information visualization and participatory art installations and performance.

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[1] http://openframeworks.cc

[2] http://www.ofxaddons.com/categories

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