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AME 494: Responsive Environments Final Project
Fall 2018

* Video at: https://youtu.be/Ryepymo5Qwk

Frames

Frames is a project that traces and visualizes the history of objects' movement through a space. It outputs an overlay of a series of discretized object detection frames over time. This output can be displayed or projected within the space.

This system utilizes a camera as input and uses background subtraction and frame differencing to track objects and motion in view. When a certain amount of motion is detected, a discretized object detection frame is captured, colorized, and then output into a custom feedback system. The color of each frame can be specified, randomized, or, as in the case of this project's first exhibition, controlled by an external source. Color values are received from a different project. The green and blue channels of these values are inverted and then used to color the frames being output. The average color of the final output is then calculated and sent back to the system from which color is being received. This creates an ecosystemic relationship between the two systems formed by the cyclical passing of data. The system also has controls for the fade rate and blur rate of the feedback component. This makes it possible to specify whether objects should leave long paths or fade very quickly. In earlier versions of the project, the frame capture was controlled by a static metro object, but the final version captures frames based on how much motion is detected by the system, meaning more motion corresponds to more frames captured.

During the exhibition, this system had some interesting and unexpected interactions with the other projects being presented. Because the system uses a regular camera rather than an IR camera, the projections on the floor where registered as objects. Because the projections were also interactive, this added new avenues with which users could interact with this system's output. The dark lighting environment of the final exhibition also changed the way that the camera detected objects, making the texture output by the projector influence what parts of an object were detected. These outside influences could have been removed by using an infrared camera, but in my opinion, the outside interactions of the regular camera with lighting and projections enhanced its depth as a dynamic and ecosystemic system.

Future iterations of this system would include more dynamic parameters based on the state of the environment. For example, the current amplitude of sound in the space could

correspond to the fade rate of the frames, or the system could be associated with states or moods by controlling the colors of each output frame. Considerations should also be made for times when there is no activity in the space. Perhaps when no movement is detected, the system could interweave old frames containing action that have been saved into the projection. Also, the matrix manipulation done in this patch needs to be converted to jit.gen in order to utilize the computer's graphics card. Running the calculations on the CPU has proved too much to handle for most computers, and using jit.gen would make calculations much more efficient.

Below is a diagram of the various inputs and outputs of the system:

Prefixes

Energy
energy

This value is mapped to interpolate between two presets. (0- Fast frame capture with no convolution, 1- Slow frame capture with high convolution)

Frame Capture Metro
metro

Accepts a 0 or 1 value which turns the frame capture metro on and off.

Capture Frame
capture

Any message sent with the capture prefix will trigger a frame to be captured by the feedback system.

Blur Radius
blur

The convolution size of the feedback image. (0- no convolution, 3- high convolution)

Fade Rate
rate

The speed at which the feedback image fades. (0- slow fade, 1- fast fade)

Feedback Color
r
g
b

Set the red, green, and blue values of the feedback image.

Frame Capture Delay
rate

The delay time in milliseconds between the feedback system's frame capture.

My system accepts a side view camera as input and projects an output to the monitors around the space. Background subtraction is used to detect objects in the space and create a black and white object mask. A feedback system captures frames at a specified rate, modifies the color as specified, and blurs the image as specified by the parameters. The instrument can also be programmed to capture frames at specified events through the capture frame parameter. The system outputs the frame luminance of the outputted image, the frame luminance of the object detection matrix, and the frame luminance of the frame differenced matrix to detect motion.

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Image Luminance
The frame luminance of the visual component of my instrument's output.

Object Detection
The frame luminance of the object detection matrix. (ie how much of the frame is obscured by objects.)

Motion
The amount of motion detected in the frame.