# Computational Photography
# Assignment #6
# Video Textures

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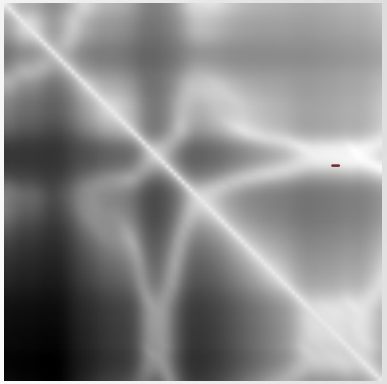
# Transition Matrices for Best Sample Conditions

Diff 1: computeSimilarityMetric()

Diff 2: transitionDifference()



Diff 3: score transition matrix from the biggest loop function

Red mark as asked in the instruction

# Best Results from Sample Input

*Start frame filename: 039.png

*End frame filename: 091.png

What alpha value produced the smoothest loop? - Value of .01 produced the smoothest loop. I tried values between .005 to 1.0 for alpha and observed the best result with alpha values between ~.007 - .02

Link to your candle video texture gif - https://media.giphy.com/media/j6Z4kJxLUlMq2NLro4/giphy.gif

** Frame filename is from original set of frames*

# Results from Sample Input

- Clearly explain your procedure to get a good result
  - The functions computeSimilarityMetric() and transitionDifference() are used to compute transition matrices. These matrices are used to compute the “score transition matrix” which is used for determining the start and the end points of the biggest loop for a given alpha value. Note: loop length is proportional to alpha values. But different sets of images might have different loop lengths for the same alpha.
  - To get a good result, I computed loop lengths with various alphas to find a decent length loop with seamless transitioning between frames to form a continuous looping.
  - For the sample I used alpha values of 1, .01, and .006 and inspected the start and final frames for continuity as well as the transition matrices to understand where I can get a good loop.

# Results from Sample Input

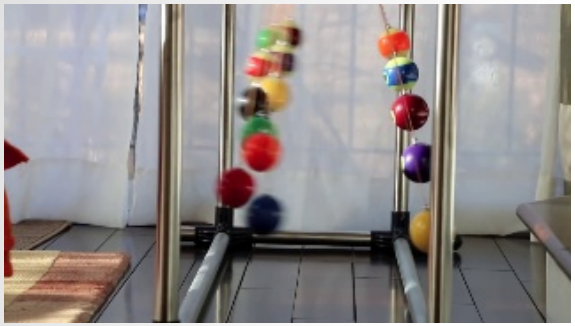

Alpha of 1.0 start and end frames do not transition well


Alpha of 0.01 start and end frames do transition well

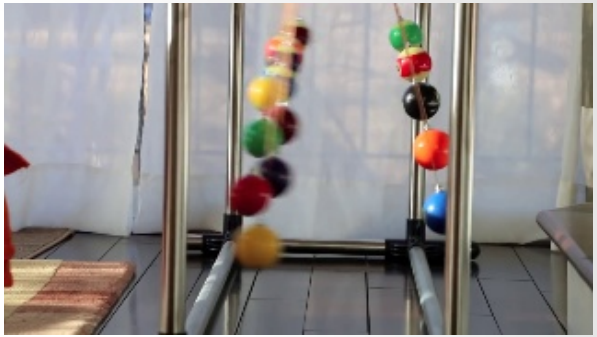
# Results from Sample Input

- What was difficult? Explain.
  - It was difficult to determine a good alpha value and required understanding the transition matrices as well as attempting different score transition matrices to get an idea how the loop length and quality of transition changes with changing alpha.
  - The Start and End frames are the most important to ensure seamless transition and find an alpha can be a bit tricky. Another task required to do so is blending the frames for a smooth transition which makes it a little more difficult.

# Best Results from Your Own Input



Start frame filename:
Index frame number: 9

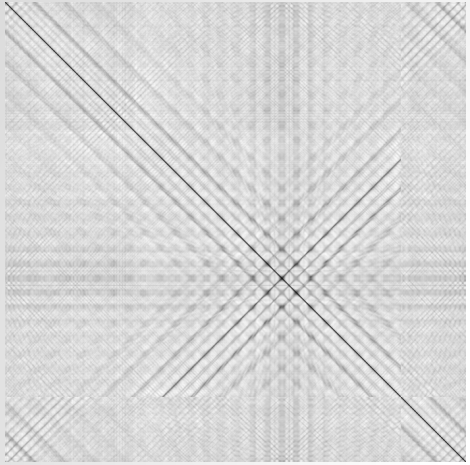


End frame filename:
Index frame number: 695

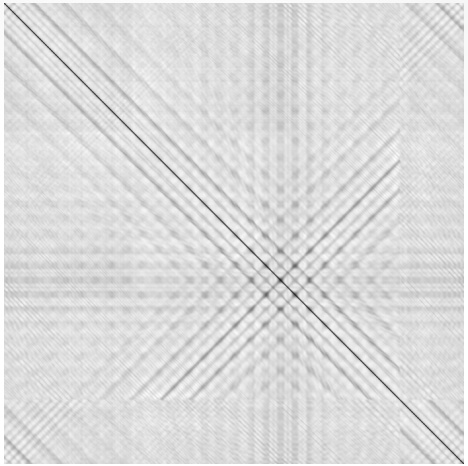
- The gif is a loop from a  youtube video of billiard balls swinging.

- Alpha value for the best loop - .01
- Link to your video texture gif -https://media.giphy.com/media/YSx0AFx5V1ATyyeG7x/giphy.gif
- Link to the frames (folder) - https://drive.google.com/open?id=1hCzbu7d12Yeg86IbJy235BwNLAhDDwKk

# Transition Matrices for Your Own Best Input



Diff 1: computeSimilarityMetric()



Diff 2: transitionDifference()

Diff 3: score transition matrix from the biggest loop function
Top corner the red mark

# Best Results from Your Own Input

Start frame filename: frame222.jpg
Index frame number: 2

End frame filename: frame.jpg
Index frame number: 819

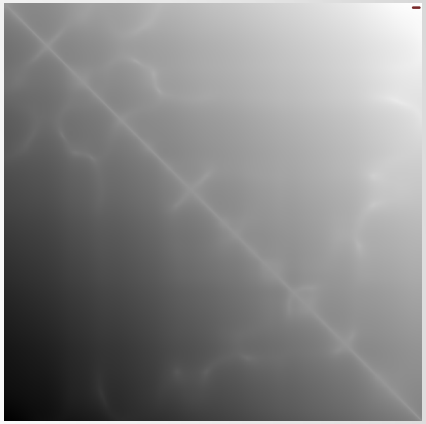
- View outside by home a tree with its branches moving in the wind

- Alpha value for the best loop - .01
- Link to your video texture gif - https://media.giphy.com/media/LQ31dGcqr28Nfq8yhJ/giphy.gif
- Link to the frames (folder) - https://drive.google.com/open?
  nVmfw3BEeF

# Transition Matrices for Your Own Best Input

Diff 1: computeSimilarityMetric()

Diff 2: transitionDifference()



Diff 3: score transition matrix from the biggest loop function
Top corner the red mark

# Results from Your Own Input

- Did you get a good result on your own video? Explain.
- My own video result is ok. There is a slight “jump” when the frames loop. This can be rectified by blending the frames so as to have a more seamless transition. The sudden transition can be rectified by a good number of frames captured at a higher frame rate and processed to capture miniscule temporal changes. Also another way would be to have smaller movements which large frame rate can help with. Choosing a good alpha value will also help as it can be used to optimize the number of frames in the loop and keep only useful frames.

# Results from Your Own Input

- How was this video different from working on the sample frames?
- The video had sudden transition at the looping frames. This did not happen with the sample frames. This transitioning can be fixed by choosing a good value for the alpha parameter. Value of alpha determines length of loop i.e. number of frames so if the number of frames is appropriate the transition could be potentially smoother. It was easier to find the alpha for the sample frames.

# Results from Your Own Input

- What was difficult? Explain
- There were a number of difficulties starting with the code functions were not optimized to handle large sets of frames and frames of large size. A compromise was required to get a decent frame set and frame size to compute the video texture in finite time. Secondly it was difficult to find a good alpha value for smooth transitions. Thirdly getting smooth transitions required some post processing which was tricky.

# Results from Your Own Input

- What would you do differently? *(Do not say “nothing”)*
- I would try different frame rates and blending techniques for transitions. The code requires to be highly vectorized and potentially use cython for faster computation to handle a good number of frames and test a number alpha values. Finally, I would also try and add secondary effects like changing colors as the frames loop. The colors would be artificially added.

# Finding Alpha

- Describe how you determined the best alpha value for each video texture (candle and your own).
  - To find the best value for alpha I tried a number of values of alpha and found the upper and lower limits i.e. where only 1 frame exists in the loop to the largest number of frames without including all frames. I compared the first and last frames and I created gifs and compared the results for transitions
- How are your results affected as alpha increases? Decreases? (Try changing by orders of magnitude, e.g., x1/10, x10, x100, etc.)
  - As alpha increased number of frames increased in the loop and as it decreased the number of frames decreased in the loop. This was tested for the frame sets I used and the results were consistent.
- Was the best alpha for your video the same as the one for the sample video? Discuss.

# Finding Alpha

- Was the best alpha for your video the same as the one for the sample video?  Discuss.
    - No the values of alpha were different. my understanding is that this depends on the frame characteristic i.e. how the videos were shot, the number of frames being used in the sets, the motion of the subject of the video.

# Above and Beyond

- I shot my own video and created a gif for it. The the frames were reduced in size to make processing faster.
- Gif Link: https://media.giphy.com/media/LQ31dGcqr28Nfq8yhJ/giphy.gif
- The subject of the video are branches on a tree outside my home in mountain view. It was windy and the branches were moving.
- The gif is just ok as it is pixelated due to resizing and the transition is not smooth enough.

# Resources

[1] Lecture notes

[2] Video Texture paper: http://cs.colby.edu/courses/F07/cs397/papers/schodl-videoTextures-sig00.pdf

[3] Billiards video from youtube: https://www.youtube.com/watch?v=JsIgubUjTck

[4] This is original work completed for spring 2019 offering of Computational Photography