

**EE368 Final Project Plan**  
**“Chroma Upsampling from Motion”**

**Title :**

Chroma Upsampling from Motion

**Abstract :**

Upsample a sequence of synthetic 4:1:1 YCbCr images to 4:2:2 YCbCr by motion registration on the Y-channel and histogram-based resampling of CbCr on the set of registered frames.

**Names & Addresses:**

Student 1 : John V. Sandusky    [jvsndsky@stanford.edu](mailto:jvsndsky@stanford.edu)

(505) 890 – 3807 home

(505) 845 – 0132 work

**Concept of Operation**

- 1) Synthesize a 4:4:4 YCbCr clip of motion video for an easy-to-register scene, such as a bouncing polychromatic square or circle
- 2) Write out a 4:2:2 YCbCr and 4:1:1 YCbCr clip using a standard chroma sampling scheme, taking some care to minimize aliasing.
- 3) Register a rolling sequence of 4:1:1 frames on the Y-component. For each frame added to the set of registered images, add the corresponding Cb and Cr values to a histogram, leading to one Cb and one Cr histogram for each pixel in the set of registered frames
- 4) Resample the registered frames to 4:2:2 YCbCr, using the pixel-by-pixel chroma histogram as a basis for upsampling
- 5) Unregister the frames and rewrite the clip as 4:2:2 YCbCr motion video
- 6) Compare the 4:2:2 YCbCr motion video obtained by registration to the 4:2:2 YCbCr obtained by direct subsampling of the 4:4:4 YCbCr clip in step (2). Quantify the reconstruction error, and comment on the visual quality of the reconstructed image compared to the 4:1:1 and the 4:2:2 directly downsampled clips. Discuss the effect that adding different types of noise would have on the recovered imagery.

This is a quantitative proof-of-concept demonstration on contrived video clips. Execution is in the Matlab environment. Color quality improvement is of primary concern, not execution speed. If the registration method were generalized, the technique would lead to a general improvement scheme for low-chroma-resolution video.

## Project Plan:

task	work-hours
1) synthesize, downsample, register, and recover	
a. synthesize some 4:4:4 color-bar motion clips. Iterates with b-c-d	8
b. downsample to 4:1:1 and 4:2:2, and keep the 4:2:2 'truth' clips as truth reference	3
c. register the 4:1:1 sequence, adding chroma values to a Cb and Cr histogram. Preferably, base registration algorithm on prior art	28
d. based on the histogram values, resample the chroma at each pixel, producing a 4:2:2 clip from the 4:1:1	6
e. write out the recovered 4:2:2 clip	2
f. calculate the MSE from the 'truth' clip and compare	2
2) write report	14
3) write poster	6
	69

## Most Difficult Aspects

- 1) downsampling and registration with sufficient speed and accuracy
- 2) determining the method for histogram-resampling onto 4:2:2 grid

## References

"A flexible display module for DVD and set-top box applications"

[http://ieeexplore.ieee.org/search/srchabstract.jsp?tp=&arnumber=628664&queryText%3Dchroma+upsampling%26openedRefinements%3D\\*%26searchField%3DSearch+All](http://ieeexplore.ieee.org/search/srchabstract.jsp?tp=&arnumber=628664&queryText%3Dchroma+upsampling%26openedRefinements%3D*%26searchField%3DSearch+All)

"Effective image splicing detection based on image chroma"

[http://ieeexplore.ieee.org/search/srchabstract.jsp?tp=&arnumber=5413549&queryText%3DInternational+Conference+on+Image+Processing%26searchWithin%3Dchroma%26openedRefinements%3D\\*%26searchField%3DSearch+All](http://ieeexplore.ieee.org/search/srchabstract.jsp?tp=&arnumber=5413549&queryText%3DInternational+Conference+on+Image+Processing%26searchWithin%3Dchroma%26openedRefinements%3D*%26searchField%3DSearch+All)

"Chroma coding for video at very low bit rates"

[http://ieeexplore.ieee.org/search/srchabstract.jsp?tp=&arnumber=531428&queryText%3DInternational+Conference+on+Image+Processing%26searchWithin%3Dchroma%26openedRefinements%3D\\*%26searchField%3DSearch+All](http://ieeexplore.ieee.org/search/srchabstract.jsp?tp=&arnumber=531428&queryText%3DInternational+Conference+on+Image+Processing%26searchWithin%3Dchroma%26openedRefinements%3D*%26searchField%3DSearch+All)

"An object-based approach to color subsampling"

<http://ieeexplore.ieee.org/search/srchabstract.jsp?tp=&arnumber=544820&queryText%3DInternational>

[+Conference+on+Image+Processing%26searchWithin%3Dchroma%26openedRefinements%3D\\*%26searchField%3DSearch+All](#)

“A Fidelity Metric for Assessing Visual Quality of Color Images”

[http://ieeexplore.ieee.org/search/srchabstract.jsp?tp=&arnumber=4317975&queryText%3DInternational+Conference+on+Image+Processing%26searchWithin%3Dchroma%26openedRefinements%3D\\*%26pageNumber%3D2%26searchField%3DSearch+All](http://ieeexplore.ieee.org/search/srchabstract.jsp?tp=&arnumber=4317975&queryText%3DInternational+Conference+on+Image+Processing%26searchWithin%3Dchroma%26openedRefinements%3D*%26pageNumber%3D2%26searchField%3DSearch+All)

“Efficient Spatial Interpolation Using a Simplified Up-Sampling Filter for Chrominance Component”

[http://ieeexplore.ieee.org/search/srchabstract.jsp?tp=&arnumber=4678688&queryText%3DInternational+Conference+on+Image+Processing%26searchWithin%3Dchroma%26openedRefinements%3D\\*%26pageNumber%3D2%26searchField%3DSearch+All](http://ieeexplore.ieee.org/search/srchabstract.jsp?tp=&arnumber=4678688&queryText%3DInternational+Conference+on+Image+Processing%26searchWithin%3Dchroma%26openedRefinements%3D*%26pageNumber%3D2%26searchField%3DSearch+All)

“A Measure for Evaluation of the Information Content in Color Images”

[http://ieeexplore.ieee.org/search/srchabstract.jsp?tp=&arnumber=1529776&queryText%3DInternational+Conference+on+Image+Processing%26searchWithin%3Dchroma%26openedRefinements%3D\\*%26pageNumber%3D2%26searchField%3DSearch+All](http://ieeexplore.ieee.org/search/srchabstract.jsp?tp=&arnumber=1529776&queryText%3DInternational+Conference+on+Image+Processing%26searchWithin%3Dchroma%26openedRefinements%3D*%26pageNumber%3D2%26searchField%3DSearch+All)

“Spatio-Chromatic Model for Colour Image Processing”

[http://ieeexplore.ieee.org/search/srchabstract.jsp?tp=&arnumber=576372&queryText%3DConference+on+Computer+Vision+and+Pattern+Recognition%26searchWithin%3Dchroma%26openedRefinements%3D\\*%26searchField%3DSearch+All](http://ieeexplore.ieee.org/search/srchabstract.jsp?tp=&arnumber=576372&queryText%3DConference+on+Computer+Vision+and+Pattern+Recognition%26searchWithin%3Dchroma%26openedRefinements%3D*%26searchField%3DSearch+All)

“Compression of Bayer-Pattern Video Sequences Using Adjusted Chroma Subsampling”

[http://ieeexplore.ieee.org/search/srchabstract.jsp?tp=&arnumber=5229234&queryText%3DTransaction+on+Image+Processing%26searchWithin%3Dchroma%26openedRefinements%3D\\*%26searchField%3DSearch+All](http://ieeexplore.ieee.org/search/srchabstract.jsp?tp=&arnumber=5229234&queryText%3DTransaction+on+Image+Processing%26searchWithin%3Dchroma%26openedRefinements%3D*%26searchField%3DSearch+All)

## **DROID needed ?**

No