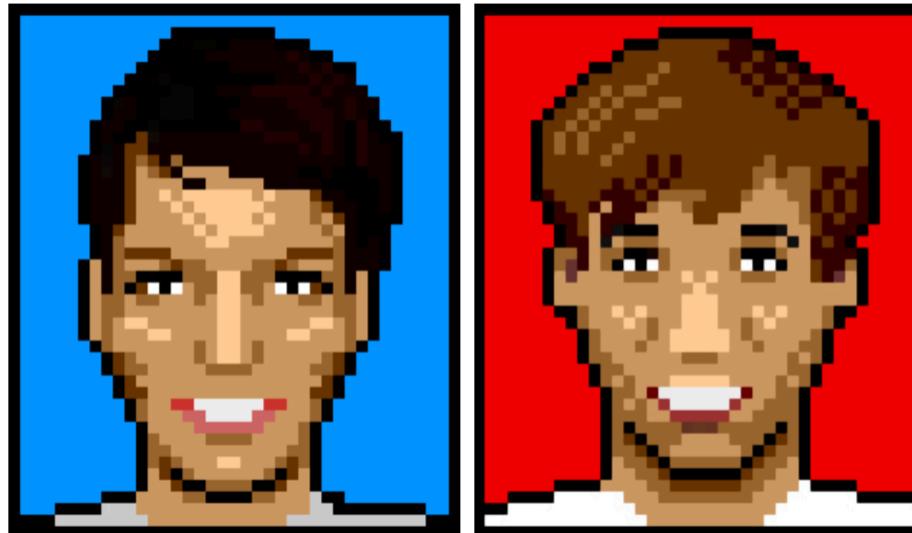


Pixelated Image Abstraction



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CSE @ TAMU

Pixelated Image Abstraction

- What is Pixelated Image Abstraction?
- Our Approach
 - Color Quantization
 - Feature Extraction
 - K-means Clustering
 - Total Variation Denoising
 - Image Downsampling
 - Nearest Neighbor Interpolation
- Qualitative Analysis
- Future Work

Pixelated Image Abstraction?

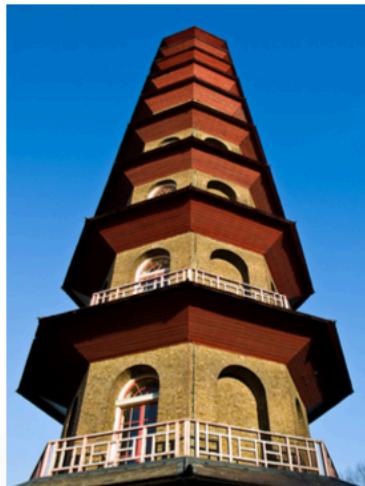
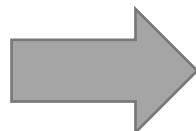


Pixelated Image Abstraction?

512 x 512 ~ 250K colors



64 x 64 - 16 colors



480 x 640 ~ 25W colors



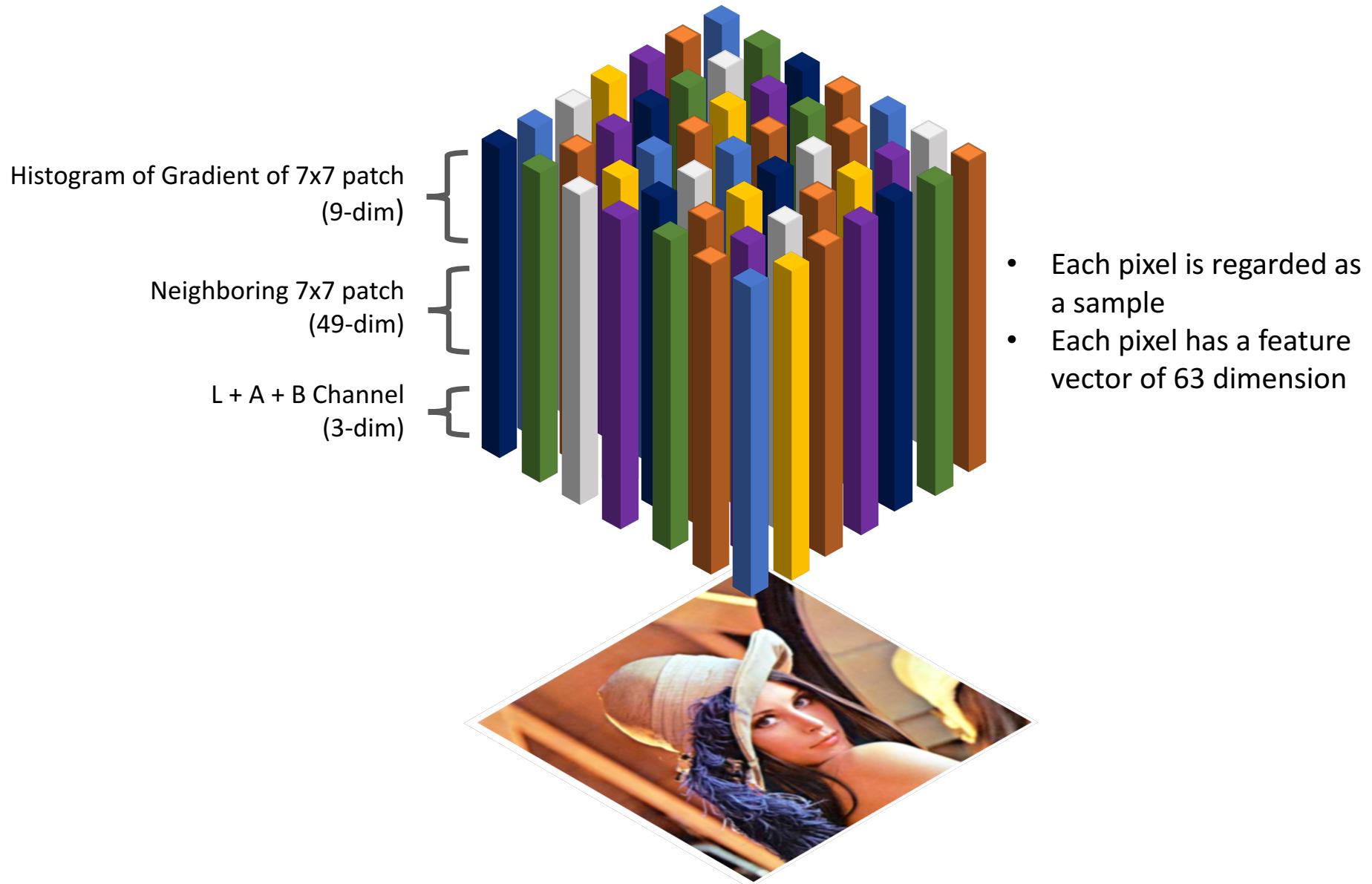
48 x 64 - 16 colors

Our Approach

Our Approach

- Color Quantization
 - Reduce Color Palette
- Image Downsampling
 - Reduce Image Resolution

Color Quantization – Feature Extraction

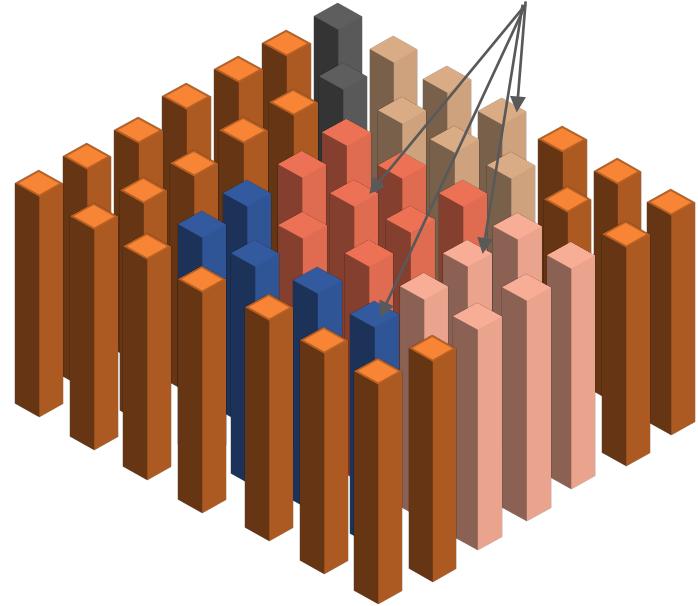


Color Quantization - K-means Clustering

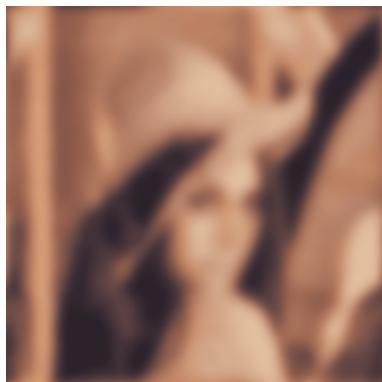
The value each pixel
is the centroid of its
belonging cluster



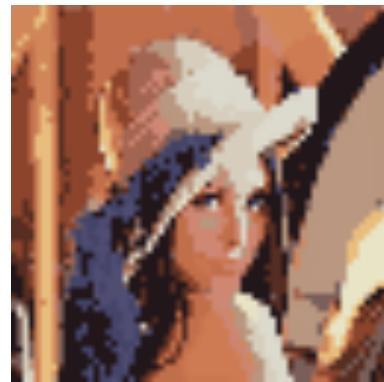
Clustering each
pixel into groups
via K-means



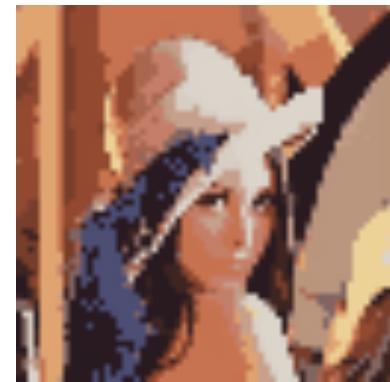
Experiments on different Feature Sets



RGB

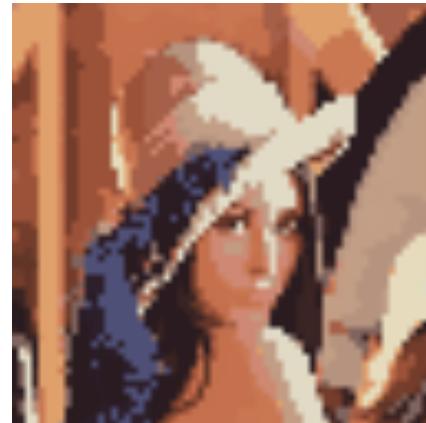
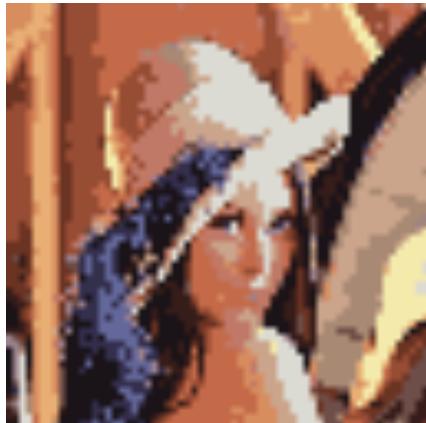


LAB



LAB + Neighbors Pixels +
Histogram of Gradient

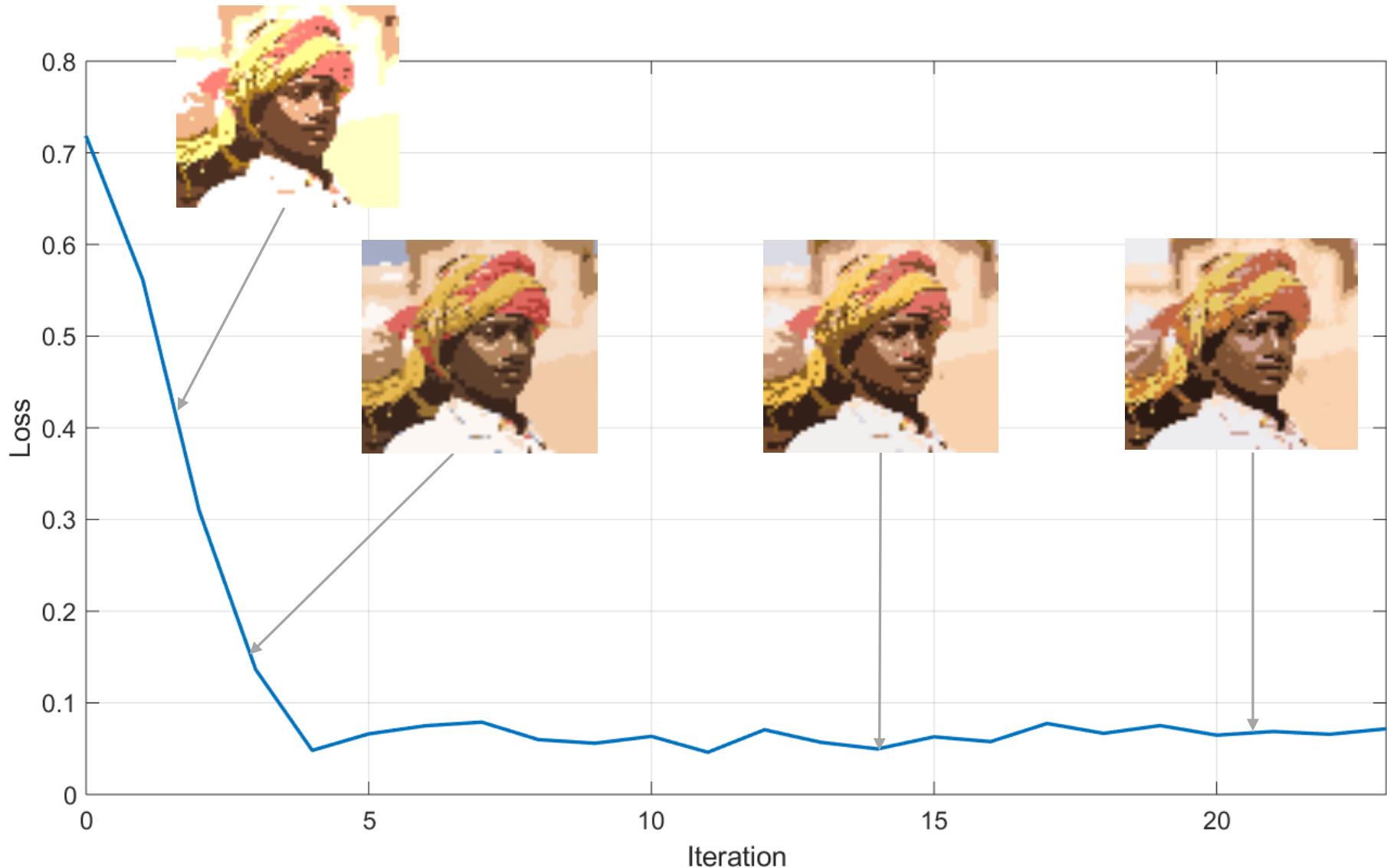
Color Quantization - Total Variation Denosing



w/o Total Variation
Denoising

w/ Total Variation
Denoising

Loss of K-means + Total Variation



Comparsion of Different Downampling Strategy



Bicubic



Bilinear



Nearest Neighbor

Qualitative Analysis

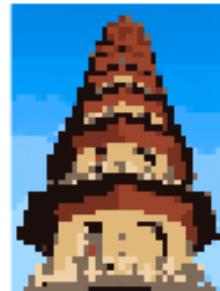
Comparsion Methods

- **Pixelated Image Abstraction**
- Timothy Gerstner, Doug Decarlo, Marc Alexa, Adam Finkelstein, Yotam Gingold, Andrew Nealen.
2012. Proceedings of the International Symposium of Non-Photorealistic Animation and Rendering (NPAR 2012)
 - Based on SLIC and Mass Constrained Deterministic Annealing (MCDA)

original image



iteration3



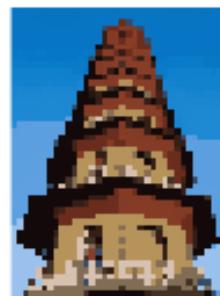
iteration6



iteration9



iteration12



iteration15



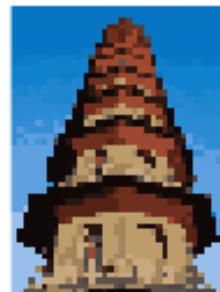
NPAR 2012



iteration18



iteration21



iteration24

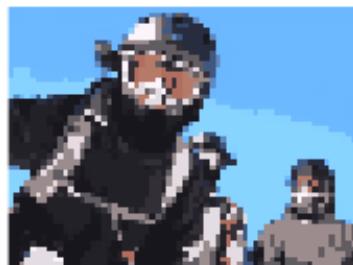


48 x 64 - 16 color

original image



iteration3



iteration6



iteration9



iteration12



iteration15



NPAR 2012



iteration18



iteration21



iteration24



64 x 48 - 16 color

original image



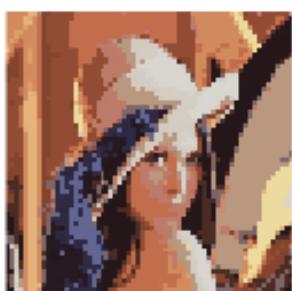
iteration3



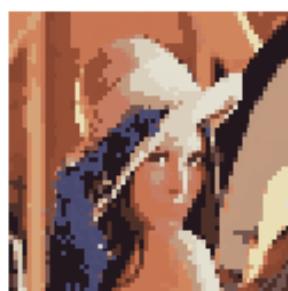
iteration6



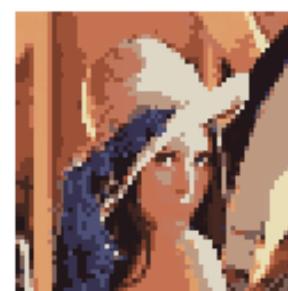
iteration9



iteration12



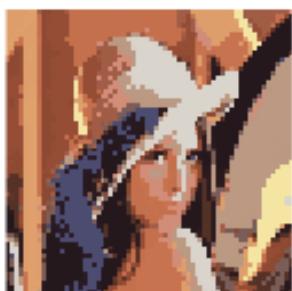
iteration15



NPAR 2012



iteration18



iteration21



iteration24



64 x 64 - 16 colors

original image



iteration3



iteration6



iteration9



iteration12



iteration15



NPAR 2012



iteration18



iteration21



iteration24



64 x 58 - 16 colors

original image



iteration3



iteration6



iteration9



iteration12



iteration15



NPAR 2012



iteration18



iteration21

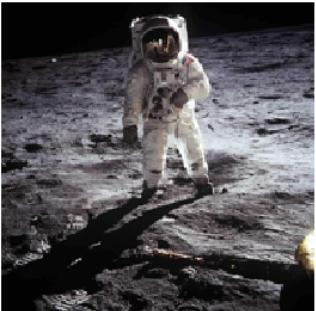


iteration24



64 x 43 - 16 colors

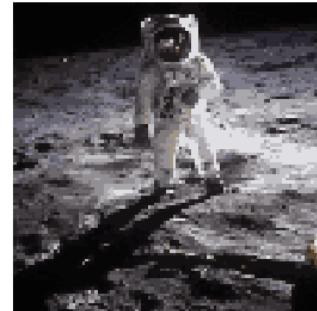
orignal image



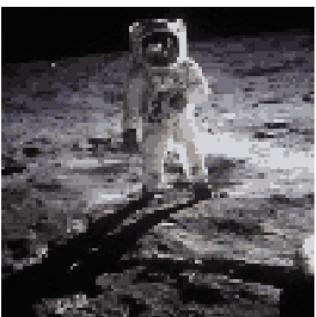
iteration3



iteration6



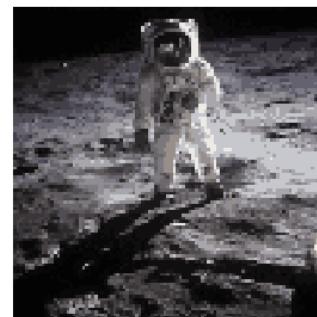
iteration9



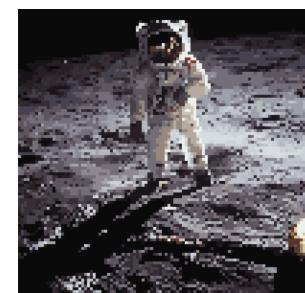
iteration12



iteration15



NPAR 2012



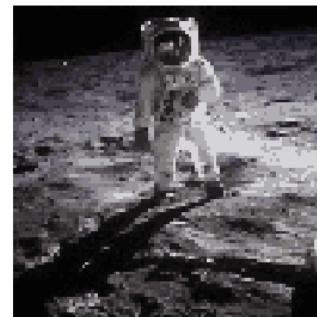
iteration18



iteration21



iteration24



100 x 100 - 24 colors

original image



iteration3



iteration6



iteration9



iteration12



iteration15



NPAR 2012



iteration18



iteration21



iteration24



42 x 64 - 8 colors



NPAR 2012



64 x 43 - 12 colors

Some Fail Cases

original image



iteration3



iteration6



iteration9



iteration12



iteration15



NPAR 2012



iteration18



iteration21



iteration24



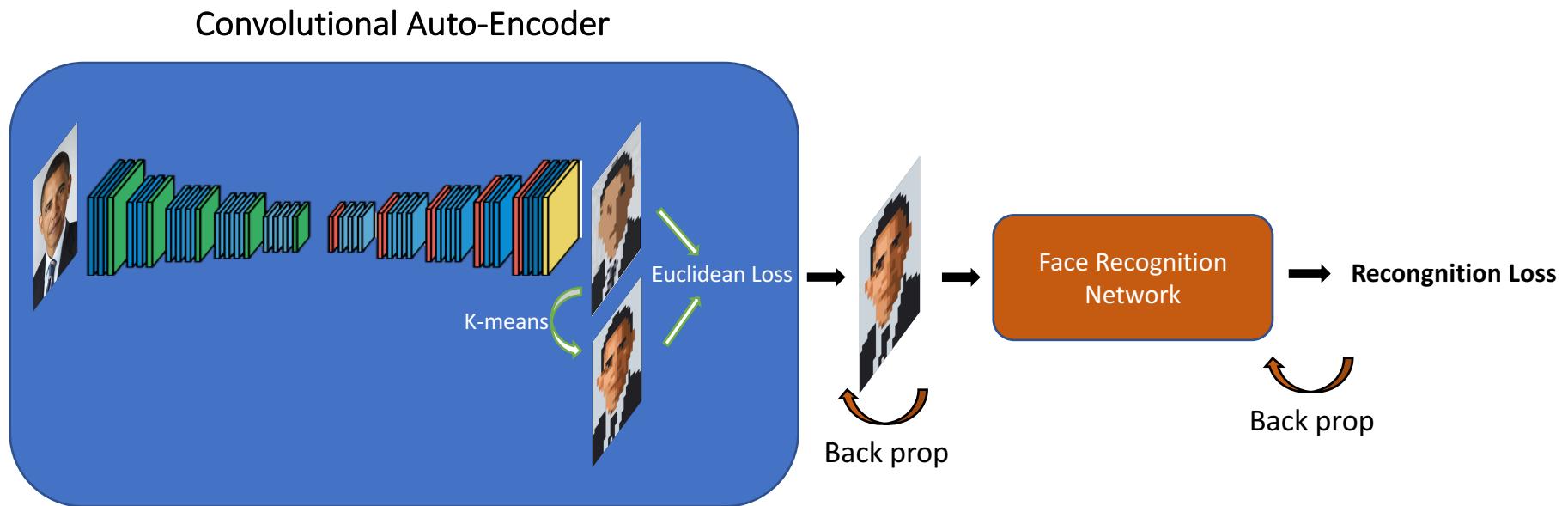
22 x 32 - 8 color

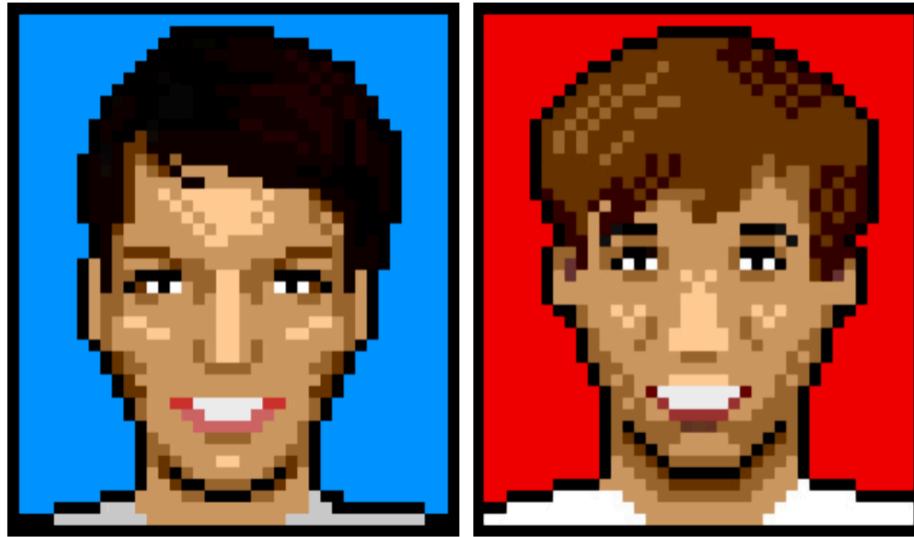
Future Work

Future Work

- How to do quantitative evaluation on Pixel Arts?
 - User Study
 - Double blind test on Amazon Turk Machine
- How to preserve semantic information in Pixel Arts?
 - Use a tunable deep network to do clustering
 - Attach an Recognition/Retrieval network to it and jointly train

Face Recognition Network with Recognition Loss





Thanks for Your Attention!