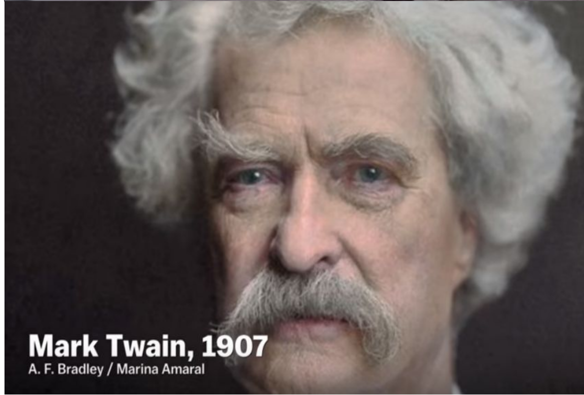
"[Colorized photos] show people and moments in history that have never been seen in color"

- *Vox*

London, 1912
Dana Keller


Mark Twain, 1907
A. F. Bradley / Marina Amaral

France, 1916
Marina Amaral

FOCUS · Colorizing Photos

Artists currently use Photoshop to **recolorize** images **by hand**

A single image may take **several days** just to colorize

Goal: Create a program that can **semi-automatically** colorize photos based on **user inputs**

PREVIOUS WORK · Colorization using Optimization

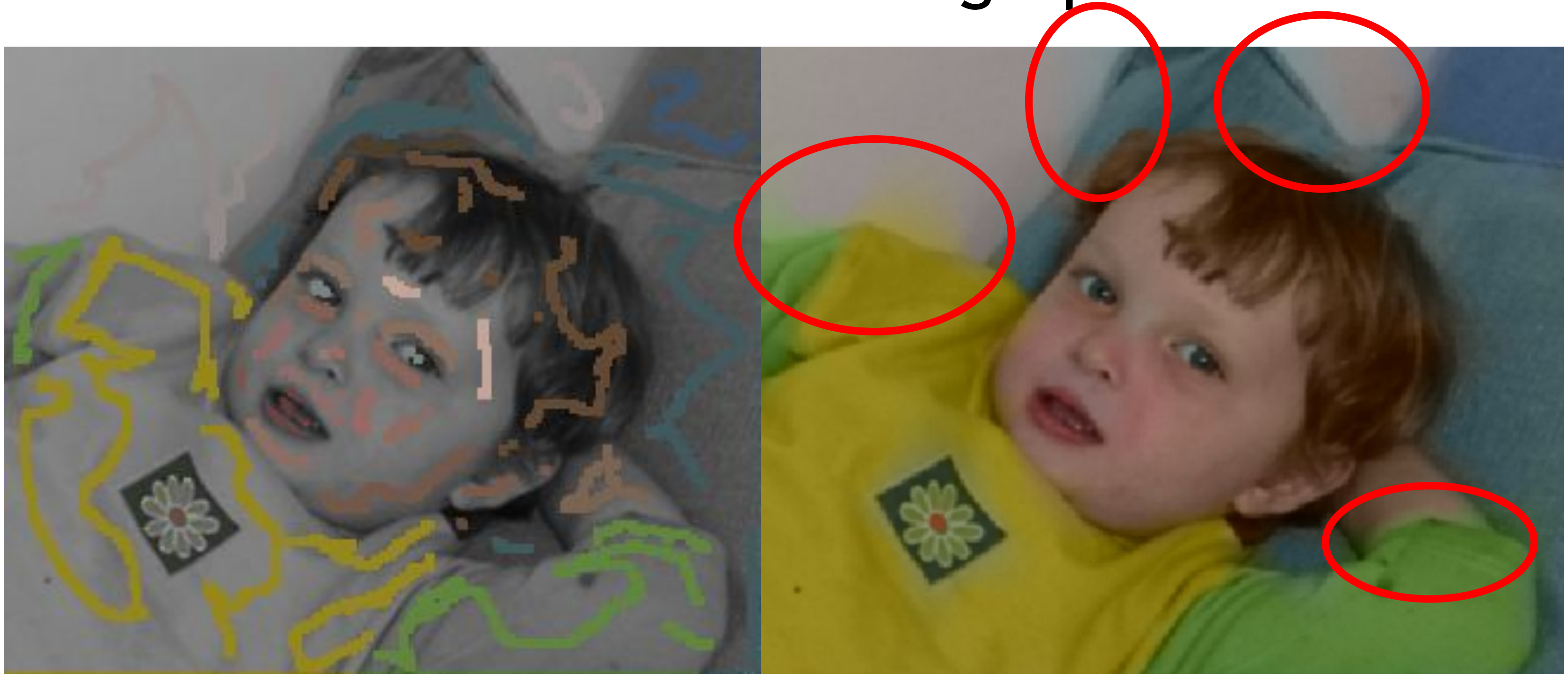
Anat Levin, Dani Lischinski, Yair Weiss

Constraint: Two neighboring pixels **r** & **s** should have similar colors if their intensities are similar

$$\omega_{rs} \propto e^{-(Y(\mathbf{r})-Y(\mathbf{s}))^2)/2\sigma_r^2}$$

The weighting function determines how similar in color **r** and **s** should be based on their intensities

PREVIOUS WORK · Colorization using Optimization



Colors don't properly spread to the edges of the object

SOLUTION · Texture Comparison

Incorporate **texture similarity** in determining the color of a grayscale image

Constraint: Two neighboring pixels **r** & **s** should have similar colors if their intensities **and textures** are similar

$$\omega_{rs} \propto e^{-((Y(\mathbf{r})-Y(\mathbf{s}))^2+\alpha SSD(\mathbf{r},\mathbf{s},\mathbf{w}))/2\sigma_r^2}$$

SOLUTION · Texture Comparison

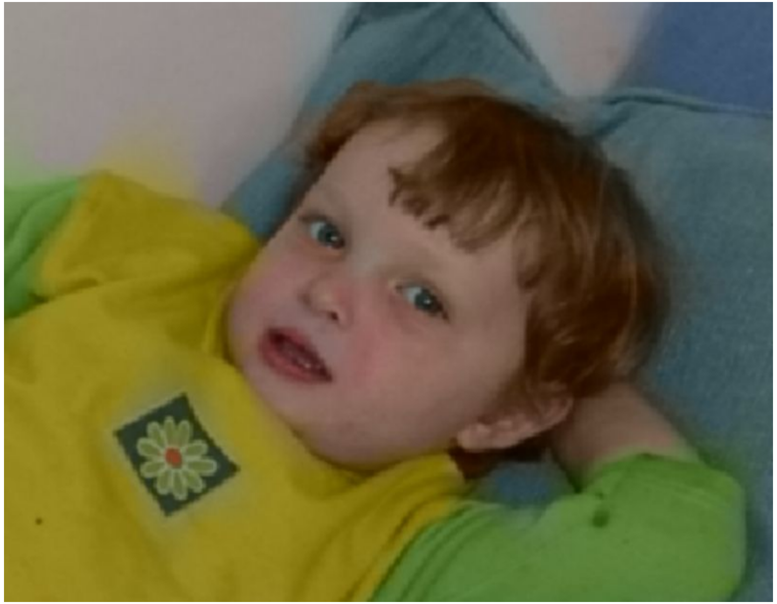
$$\omega_{rs} \propto e^{-((Y(\mathbf{r})-Y(\mathbf{s}))^2+\alpha SSD(\mathbf{r},\mathbf{s},\mathbf{w}))/2\sigma_r^2}$$

where **w** is window size, **α** is a weighting constant

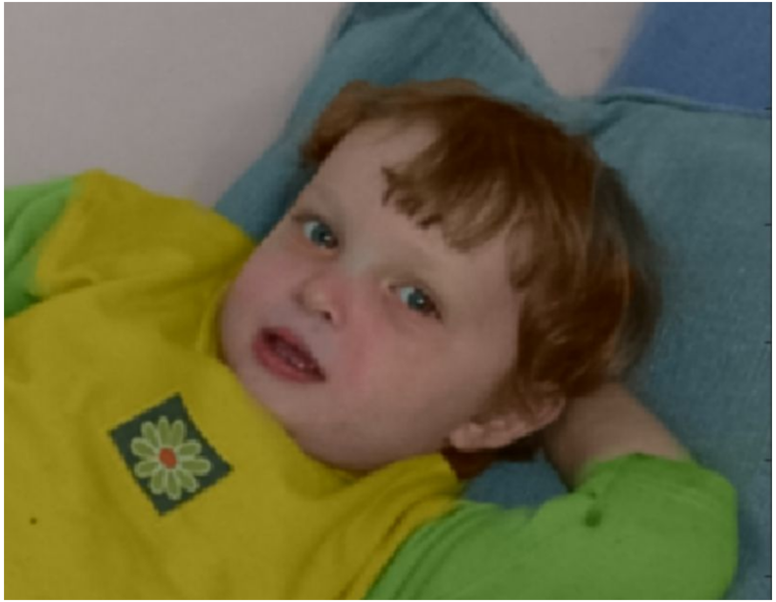
SSD(**r**,**s**,**w**) is the SSD error between a window centered around **r** and a window centered around **s** (Efros and Leung 1999)

SOLUTION · Results

$\mathbf{w}$ = 5, $\boldsymbol{\alpha}$ = 10



Levin, Lischinski, & Weiss



Incorporating Texture

SOLUTION · Conclusion

Texture similarity can be used to successfully colorize photos in a user-guided manner

Future directions: Explore **why** changing $\mathbf{w}$ and $\boldsymbol{\alpha}$ can change the results of colorized image