DIGITAL IMAGE PROCESSING

PROJECT PROPOSAL

THE FAST AND THE CURIOUS

PROJECT ID AND TITLE: Intrinsic Images in the Wild

GITHUB LINK

- https://github.com/DefUs3r/Intrinsic-Image-Decomposition

TEAM MEMBERS

- Saumya Shah 20171193
- Aniket Mohanty 20171150
- Soumyasis Gun 20171002

MAIN GOALS OF THE PROJECT

- Intrinsic image is decomposition of an image into reflectance layer and shading layer.
- $I = R \cdot S$
- Separating reflectance in scenes would enable us to perform a wide range of applications such as texture transfer between images, material recognition, image-based resurfacing, relighting, and other interior design tasks.

PROBLEM DEFINITION

- Significant recent progress has been observed on the problem of intrinsic image decomposition, due to the release of the MIT Intrinsic Images dataset
- However, intrinsic image decomposition is still very challenging, especially on images of real-world scenes. Intrinsic image is decomposition of an image into reflectance layer and shading layer.

- We will be creating a new intrinsic image decomposition algorithm designed for images of real-world scenes.
- This algorithm makes use of the fact that many surfaces in indoor scenes share the same material and reflectance, resulting in longrange sharing of reflectances across a scene (for example, a painted wall spanning an entire image).
- We build this algorithm on fully connected conditional random field (CRF) which has been used for image detection and segmentation to enable such long-range connections in our algorithm.
- We train our algorithm on this Intrinsic Image dataset to find the most optimal values for all the hyperparameters involved in the algorithm.

ALGORITHM

1. First, a set of reflectances **R*** that are likely to exist in the image are hypothesized.
2. The set **R*** is unique for each image and, for a typical run of our algorithm, will contain multiple entries once our algorithm converges. After first choosing an initial set of reflectance colors **R*** using clustering, we iterate between 2 stages:
    a. We label each pixel with a reflectance chosen from **R*** such that $p(R^*, S^* \mid I)$ is maximized. Where **R*** is the reflectance layer, **S*** is the shading layer and I is the given image.
    b. We adjust the reflectances in **R*** by minimizing discontinuities in the shading layer **S***.
3. The first stage improves the reflectance layer, and is optimized using discrete labeling; the second stage improves the shading layer, and is optimized using continuous L1 minimization.

RESULTS OF THE PROJECT

- This algorithm should perform very well for real-world scenes.
- While it is particularly good at finding a single reflectance to explain large continuous regions, it can also handle intricate textures such as wallpapers and bricks. Even when there are many surfaces that do not fit the diffuse reflectance model (such as glossy metals or tinted windows), the model often would be returning a reasonable result.

PROJECT MILESTONES AND EXPECTED TIMELINE

- Milestone 1 (*02 Oct*) :- Analysis of paper and designing flow of implementation
- Milestone 2 (*12 Oct*) :- Data preprocessing and initialization
- Milestone 3 (*23 Oct*) :- Developing probability model and optimizing reflectance using fully connected Conditional Random Field(CRF).
- Milestone 4 (*2 Nov*) :- Optimize for shading
- Milestone 5 (*9 Nov*) :- Training algorithm for optimization. Testing
- Milestone 6 (*16 Nov*) :- Preparation of results and demonstration.