Vishion Literature Review

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Literature

A New Intrinsic-Lighting Color Space for Daytime Outdoor Images

https://ieeexplore.ieee.org/document/7792614
Proposal of a new color space representing intrinsic colors and illumination. This is based on Retinex Theory and the idea of intrinsic images which may be considered the groundwork of separating reflectance and illuminance. The basic idea is to separate the color of an object from the lighting, to represent the ambient diffuse color (in computer graphics terms.) In this paper, they built a machine learning algorithm to extract the shadow information and present a matte representation of the colors of a scene. This could provide useful to us as we attempt to remove color variation from an object.

The high dynamic range imaging pipeline: Tone-mapping, distribution, and single-exposure reconstruction

http://liu.diva-portal.org/smash/record.jsf?pid=diva2%3A1206025&dswid=6881
This is more of a reference guide than a journal of techniques. It provides an in-depth description of high-dynamic-range photography and how post processing techniques are used to provide higher contrast at all light levels. It covers traditional techniques as well as machine-learning approaches. This will be useful for reference for adjusting exposure levels.

Low lighting image enhancement using local maximum color value prior

https://link.springer.com/article/10.1007%2Fs11704-015-4353-1
In low light environments photos degrade due to airlight interference and standard sensor noise, local maximum color value is used to determine exposure degradation which in turn can be used to influence the contrast correction models. This would be useful for low light images.

Intrinsic Images in the Wild

http://opensurfaces.cs.cornell.edu/publications/intrinsic/
In this research paper, the team from Cornell University worked on the seperating the reflectance layer and shading layer from an image. They have a public database and code for

around 5000 images. In the research, based on their database, they develop a dense CRF-based intrinsic image algorithm for their images in the wild that outperforms other state of the art intrinsic image algorithms. Getting optimal solution is still a challenge and all their database and code is public to users to support future research of this problem. The Cornell team already have an intuitive tool for the users to learn more about their model. This paper can help us maybe replicate the same process for our users so that we can determine which one is shadow and not or which side is darker because of low light and which side is not so we can predict the correct color of the shirt. More info at http://intrinsic.cs.cornell.edu/

A Statistical Approach for Real-time Robust Background Subtraction and Shadow Detection

http://vast.uccs.edu/~tboult/frame/Horprasert/HorprasertFRAME99.pdf
This paper provides us with an algorithm to detect moving objects from a static background scene that contains shading and shadows using color images. It works based on a computational color model which separates the brightness from the chromaticity component. Their results are better and faster compared to others. The paper provides us with a wonderful algorithm which can give be used to extract any moving objects from an image without their shadow. The algorithm also shows promising results and procedure on how to accomplish that on our own. Something like think this would be really helpful to accomplish our task as we can extract the shirt / item / object from the image that the users wants to detect.

The Measurement of Highlights in Color Images

https://link.springer.com/content/pdf/10.1007%2FBF00836279.pdf
In this paper, the team is presenting an approach to color image understanding that accounts for variation in colors due to highlights and shading. They present a method that exploits the difference between object color and highlight color to separate the color of every pixel into a matte component and a highlight component. This way, they generate 2 intrinsic images, one with the highlights and one without them. This approach can be really helpful to us because this way we can remove the highlights on our object from other variables in the environment in order to predict the true color of it. However, I am not sure how much of it would be helpful because the algorithm looks good but only in laboratory setting. So we are not sure on how scalable it can be.

Adaptive Background Mixture Models for Real-Time Tracking

https://www.computer.org/csdl/proceedings/cvpr/1999/0149/02/01492246.pdf

This method involves background subtraction. It is basically a subtractor to remove and highlight the actual difference between 2 identical backgrounds. The paper discusses modeling each pixel as a mixture of Gaussians and using an on-line approximation to update the model. Their resulting system has been running continuously in a stable, outdoor, indoor, motion clutter and scene changing environment even through rain and snow and has been working for 16 months at the time of the paper. This can be useful to use to again, extract the object from the environment that the user wants to detect.

Tackling Color Identification

https://blog.algolia.com/how-we-handled-color-identification/
It includes the approach used to identify the color of a dominant object in a picture. The main focus here is to boost the ranking of objects for which the colors closely represent the one mentioned while searching. The blog mentions 2 existing applications which have tried to address color identification: 1) Open source scripts like josip/node-colour-extractor or lokesh/color-thief: 2) Commercial applications like vue.ai. The problem with the first approach is that if used directly, it detects the color of the background as the main color of the given image. Also, these scripts do not provide a word for the color, instead return indexes of RGB values. For identifying the color, the method mentioned in the blog does not make use of deep learning techniques but instead uses simple methods like flood filling, edge detection, clustering algorithms to group similar pixels together. To recognize the exact shade, the distance between RGB values and their projection on the grey plan is computed.

Improving color correction across camera and illumination changes by contextual sample selection

https://hal-univ-bourgogne.archives-ouvertes.fr/hal-00719790/document
Although the Macbeth color checker is a useful tool for calibrating color with different camera sensors and lighting conditions, it is impractical to assume its use with subject matter. This paper explores using different color charts to better calibrate colors using machine learning techniques. We will be using similar systems but have to rely on more general assumptions of the composition of a photo as we can't expect users to have color cards in every shot.

True color accuracy in digital forensic photography

https://europepmc.org/abstract/med/27386623
This paper talks about all the requirements of how a forensic photo should be accurate and be able to provide the true color of the objects in the photo so it is really helpful to officials during investigation. This paper particularly talks about a calibration tool called SpyderCheckr. According to them, this tool can capture the best and most realistic true colors. This tool is a technical calibration tool for digital cameras tested in the study. The author mentions to consider the use of color management tool where the images demand high true color accuracy. I think

researching more into this paper would be really helpful for us because we want to find out the true color of the object. Our project in a way is also like investigating a photo and hence this paper is relevant while we are developing our project.

Different Color Detection in an RGB Image

https://www.journalijdr.com/sites/default/files/issue-pdf/9748.pdf
This paper mentions methods to extract objects of interest based on colors. The process includes separation of RGB color layers. The values are thresholded and then masked using logical operators. The logical operators are altered according to the shade required. If the required color or required area of interest is not properly extracted then either the threshold values of color contents are changed, or the trend of logical operators are changed. This masked image is then multiplied with the original image to extract the object of interest.

Literature Summary

The majority of articles we've found have been focused on removing shadows and gradation from objects, not correcting colors based on lighting sources. If we use the above techniques for reflectance extraction, we can focus on providing a color space from our images. We will most likely be splitting our task into two: 1. Correcting based on a lighting color space. 2. Removing the specular and diffuse effect of lighting.

Open Source Tools

Node Color Extractor

josip/node-colour-extractor
Color palette generator built with Node.js

Color Thief

lokesh/color-thief
Similar to Node Color Extractor

Color Extractor

https://github.com/algolia/color-extractor
Color extractor for use on clothing

Open Surfaces

http://opensurfaces.cs.cornell.edu
Library of materials and related reflectance

SpyderCheckr

https://www.datacolor.com/photography-design/product-overview/spyder-checkr-family/
Basically a color dictionary

Open Source Summary

Not many tools beyond color palette generation, at least not for automated color correction taking a standardization of lighting into account. Unfortunately there isn't too much labeled data for this either; the above materials library is limited due to the lack of lighting information and most photos with labeled lighting set-ups don't contain accurate color information.

Industry Solutions

Vue.ai

Vue.ai
Suite of marketing tools for fashion like item identification and style suggestions. Seems like it could be a direct competitor to Vishion in the market space. Does not focus on color information though.

Industry Summary

The competitor above doesn't really focus on color based detection, instead matching objects with known products. It doesn't appear that anyone is currently exploring standardized color correction.