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Robust Color Correction Approaches for Texture Mapping Applications

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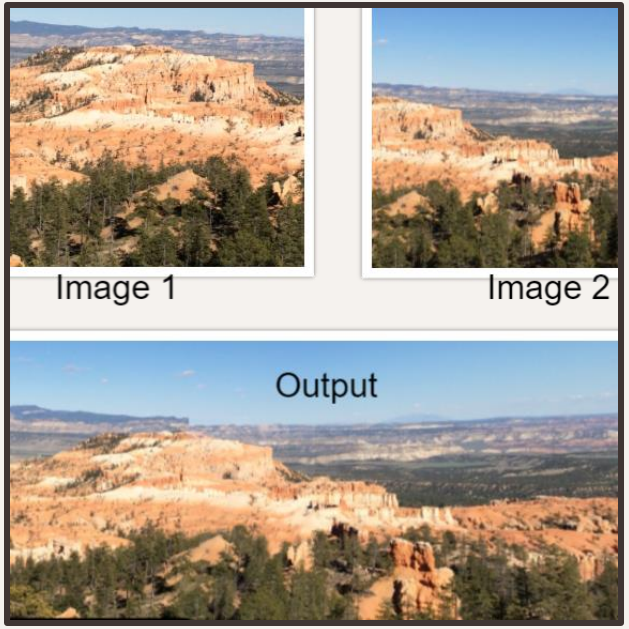
Data Acquisition and Analysis, 2022

Problem Definition

Problem Definition

Image Stitching



Texture Mapping

Color Correction

- General problem of compensating the photometrical disparities between two coarsely geometrically registered images.

Source Image

Target Image

Color Correction

S

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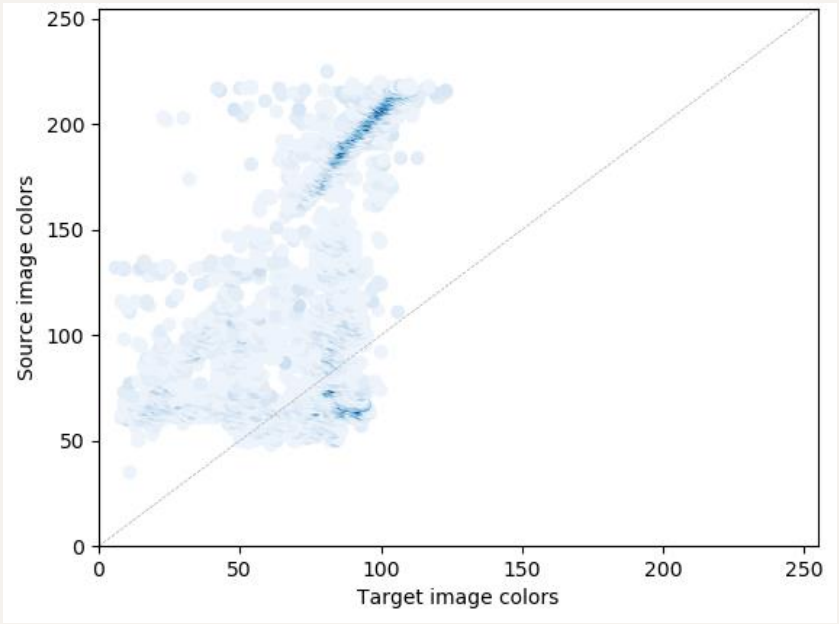
JIH



Color Correction

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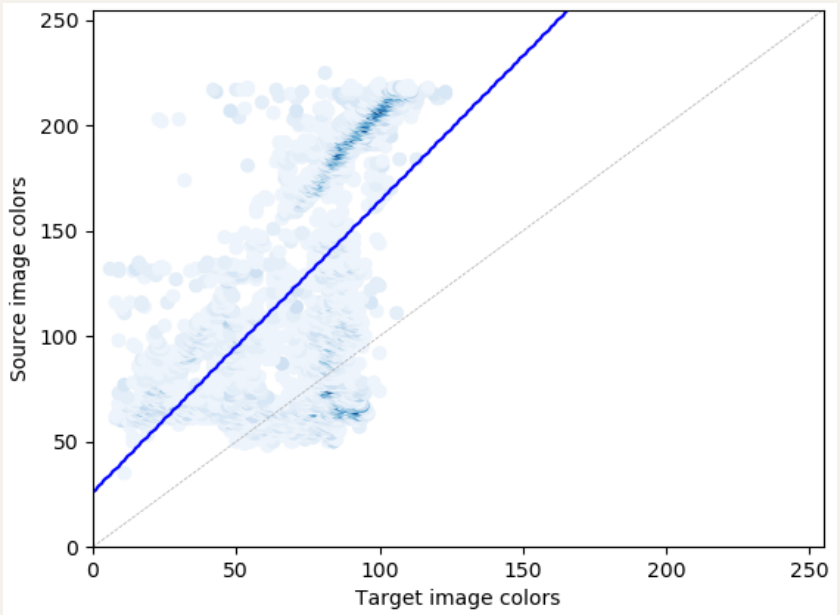
JIH



Color Correction

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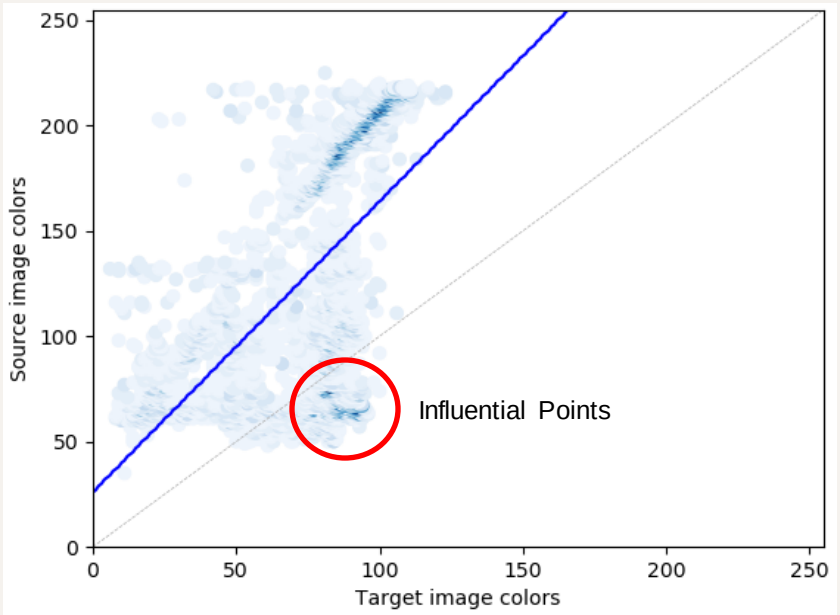

Color Correction

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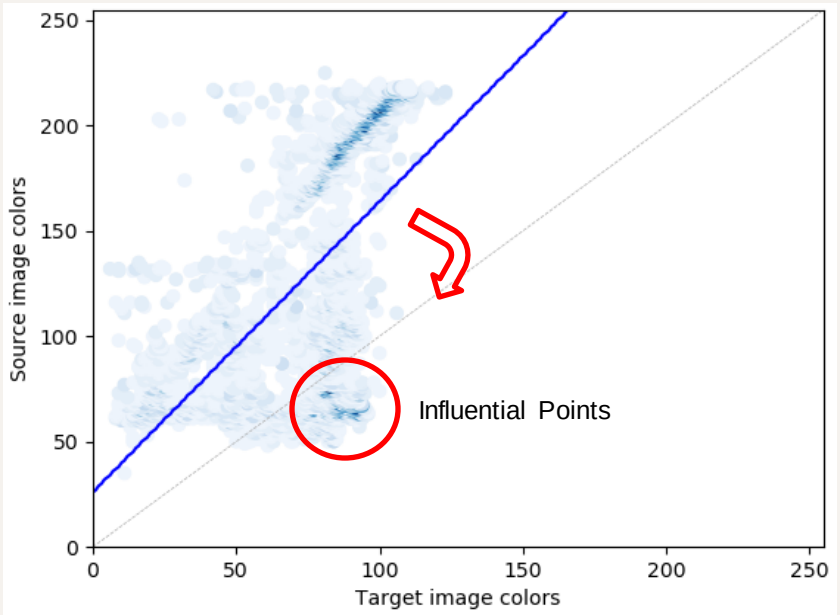

Color Correction

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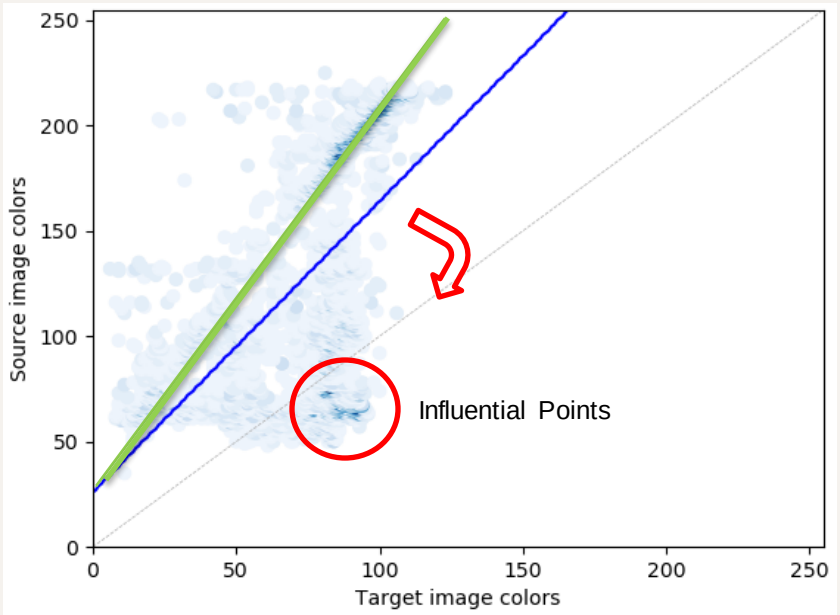

Proposed Approaches

01
Filtering Procedure

02
Robust Regression

Filtering Procedure

- Pre-process JIH to filter out the majority of influential points.
- It comprises three filtering methods based on the understanding of the real world:

Z-buffering

Depth Consistency

Camera Viewpoint

Filtering Procedure

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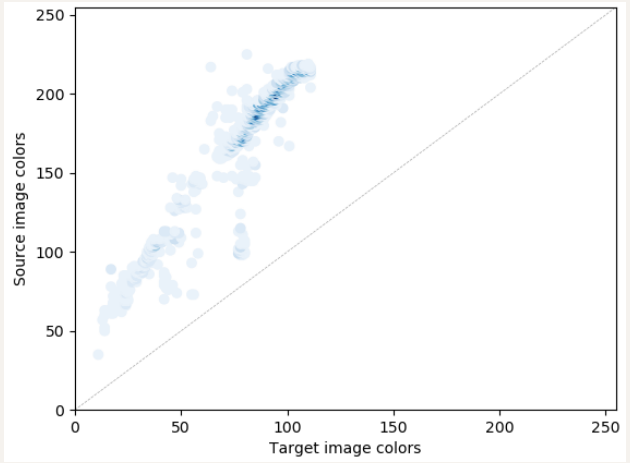

Filtering Procedure

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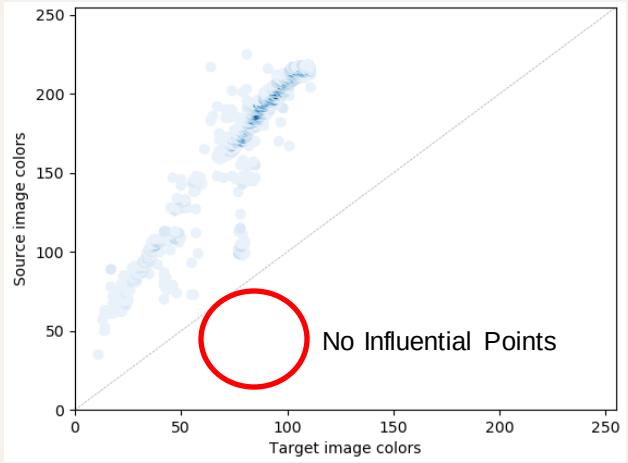

Filtering Procedure

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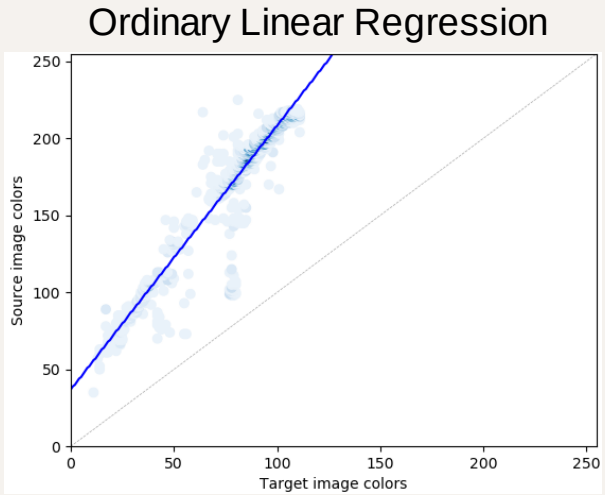

Filtering Procedure

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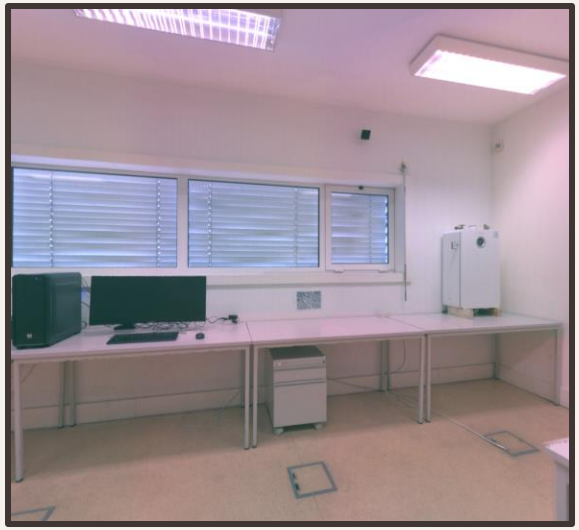
T- Corrected



Filtering Procedure

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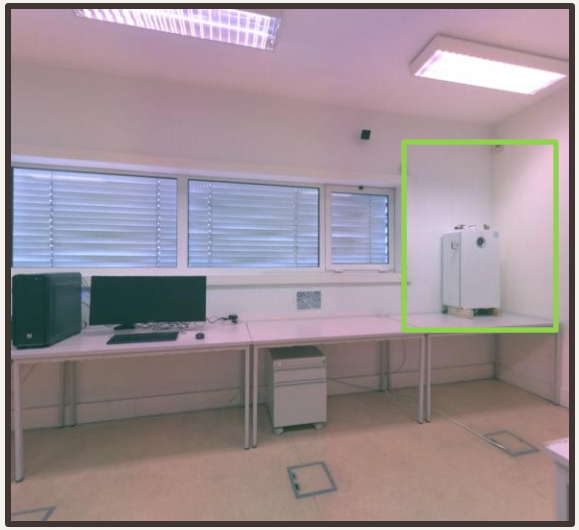
T- Corrected



Robust Regression

- Regression that gives less weight to the influential points.
- Several robust regressions were implemented, such as Huber regression, RANSAC regression and Theil Sen regression. The one that achieved the best results was **RANSAC.**
- In this approach the JIH remains unchanged.

Robust Regression

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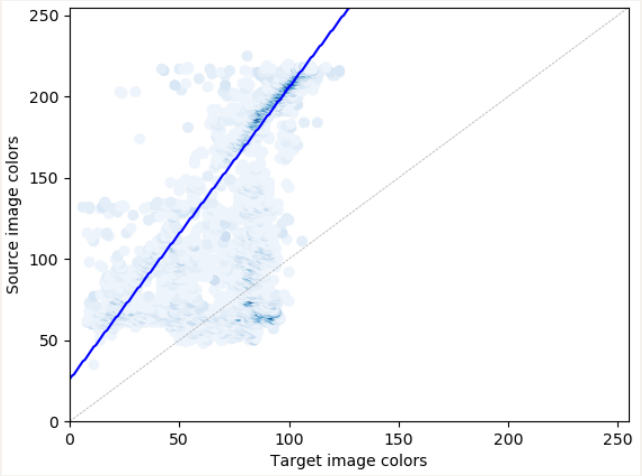

Robust Regression

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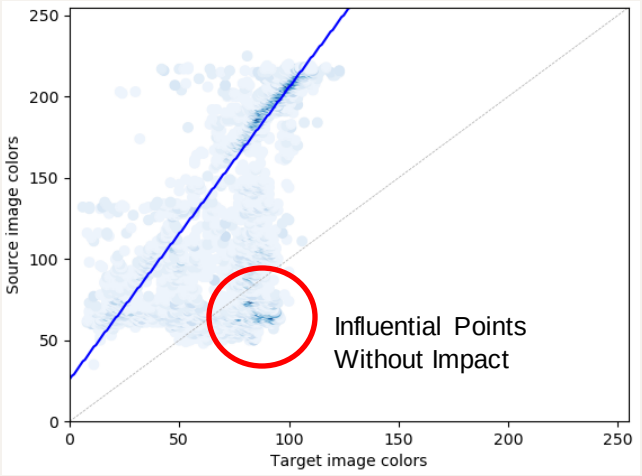

Robust Regression

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T- Corrected

Robust Regression

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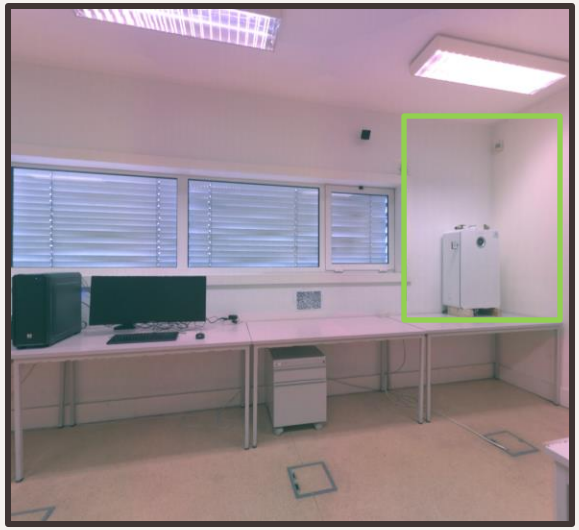
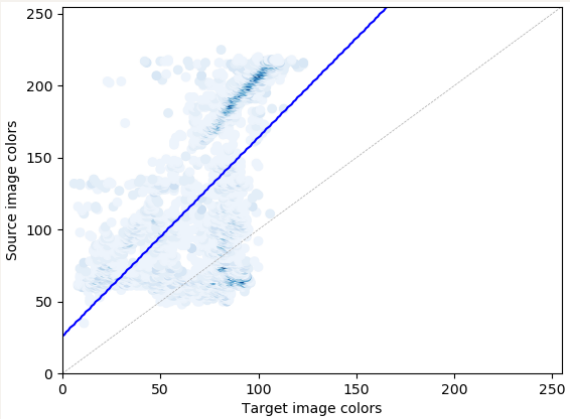


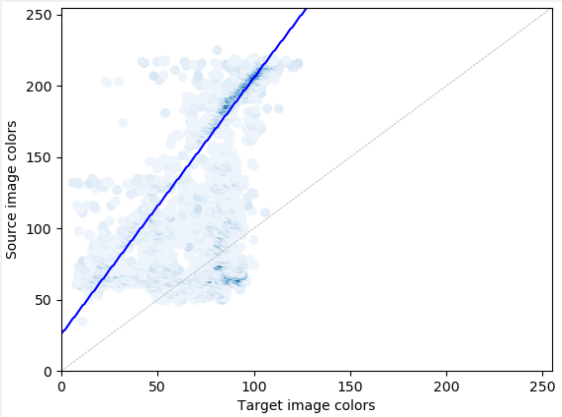
How to measure the effectiveness of color correction approaches?

Fitting error?

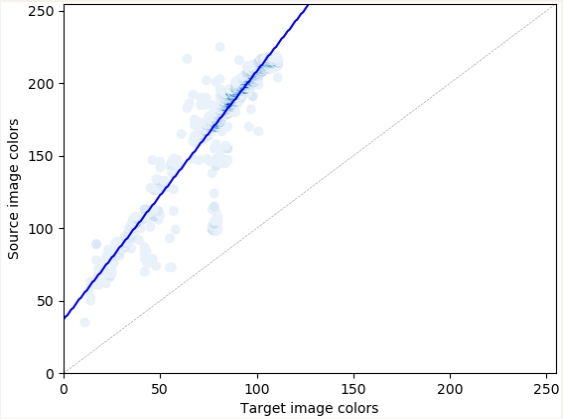
MSE? RMSE?



Ordinary Linear Regression



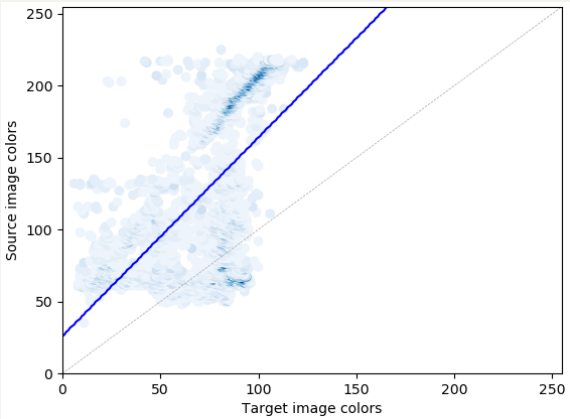
Robust Regression



Filtering Procedure

Fitting error?

MSE? RMSE?



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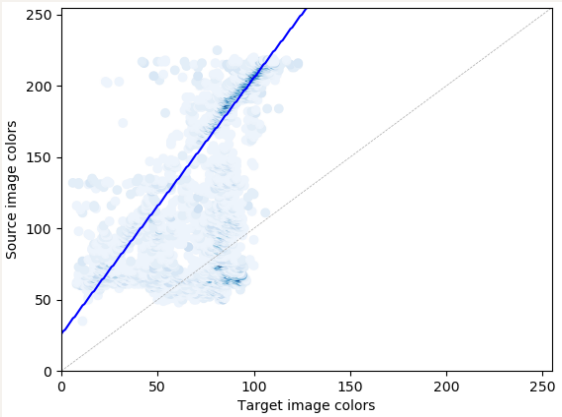

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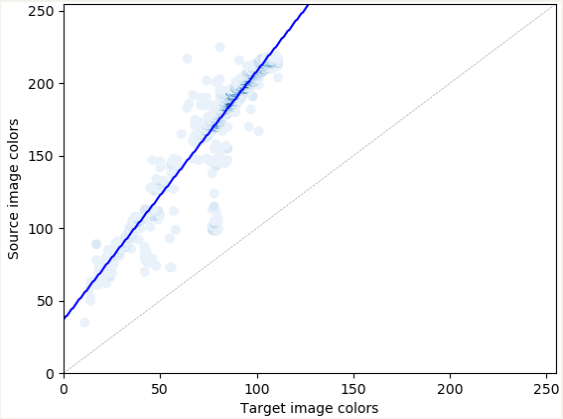

Filtering Procedure

Image Similarity Metrics?

MSE? PSNR? CIEDE 2000?

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Ordinary Linear Regression

Robust Regression

Filtering Procedure

Image Similarity Metrics?

MSE? PSNR? CIEDE 2000?

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Ordinary Linear Regression

Robust Regression

Filtering Procedure

Qualitative Analysis of Textured Meshes

Baseline
(No Color Correction)

Qualitative Analysis of Textured Meshes

Baseline
(No Color Correction)

Ordinary
Linear Regression

Qualitative Analysis of Textured Meshes

Baseline
(No Color Correction)

Ordinary
Linear Regression

Robust Regression

Qualitative Analysis of Textured Meshes

Baseline
(No Color Correction)

Ordinary
Linear Regression

Robust Regression

Filtering Procedure

Qualitative Analysis of Textured Meshes

Baseline
(No Color Correction)

Ordinary
Linear Regression

Robust Regression

Filtering Procedure

Conclusions

- The filtering procedure achieved the best results for the dataset studied.
- Nonetheless, the filtering procedure also involved more complexity that the robust regression. Furthermore, as the filtering procedure was designed for this scenario, further research is necessary to prove the applicability on different scenarios.