Dense Labeling with User Interaction: an Example for Depth-Of-Field Simulation

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INTRODUCTION

Many problems in Computer Vision can be formulated as a dense labeling problem.

Common dense labeling techniques require a high computational cost for interactive applications.

Besides, adding user knowledge in automatic systems can produce better solutions: interactive feedback.

RELATED WORK

Markov Random Fields (MRF):
- discrete labels
- high execution time for interactive applications

Random Walks:
- one linear system per label
- discrete labels with seeds

CONTRIBUTIONS

- Efficient dense labeling approach
- Interactive application for D-o-F simulation

REFERENCES


FORMULATION

Model the image as a graph:
- nodes N Slic superpixels [1]
- edges E relationships between superpixels.

- Continuous set of labels: real numbers in [0,1].
- Linear system of equations:

\[ A \cdot x = b \]

where:

\[ a_{i,j} = \begin{cases} 1 & \text{if } i = j, \\ 0 & \text{otherwise} \end{cases} \]

Binary equations:

\[ a_{i,j} x_i + a_{j,i} x_j + c_{i,j} = 0 \]

Unary equations:

\[ f_p = z \]

EVALUATION

AUTOMATIC DENSE INPUT

SPARSE USER INPUT

CONCLUSION

- Our approach is the fastest to obtain a solution while keeping comparable quality in the results.
- The dense labeling pipeline has great flexibility to model this problem and has the advantage of providing an interactive solver.
- We believe that our approach will inspire future research for interactive editing applications based on dense labeling.

MORE INFORMATION

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Code: https://github.com/unizarlab/app_3dunlab

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