Color Preserving Image Transformation with Scissor Collage

Ziv Epstein[1], Robin Pollak[1], and Dmitriy Smirnov[1]

1 **Computer Science Department, Pomona College**
Claremont,CA
{ziv.epstein, robin.pollak, dmitriy.smirnov}@pomona.edu

Abstract

1998 ACM Subject Classification I.3.5 Computational Geometry and Object Modelling – Geometric Algorithms, languages and systems, K.3.1 Computer Uses in Education – Computer-assisted instruction

Keywords and phrases polygonal congruence, color matching, image transformation, geometry, rigid transformations

Digital Object Identifier 10.4230/LIPIcs.SoCG.2016.66

1 Introduction

2 Algorithm

We begin by accepting an uploaded photo ("target") and a search term used to retrieve a second photo ("base"). Then, using [**?**, Georg Fischer's triangulation algorithm] we split each image into polygons P_{base}, P_{target} comprised of Delaunay triangles. Next we use [**?**, k-means] to cluster the colors in each photo and select the top $k = 5$ most important colors in each photo. The two sets $Colors_{base}, Colors_{target}$ of cardinality k are then assigned a one to one mapping, ϕ, using weighted bipartite matching.
Now, for both photos, we color each triangle using the color redistribution algorithm equal areas for all k colors across all triangles. Given these equally distributed colors we now recolor each triangle from $color_i \in Colors_{base}$ to $color_{\phi(i)} \in Colors_{target}$.
Finally, we use scissors congruence to recreate P_{target} from P_{base}.

2.1 Color Redistribution Algorithm

For each triangle we compute its average color and then color it with the closest of the k colors found while clustering the target image. Then we begin to balance the total area of each color, by creating k bins with an area threshold of $T = (TotalArea)/k$, where each bin corresponds to a color. Now, for a given bin B, if B's total area $Area_B > T$ we consider the smallest triangle $t_{min} \in B$ and check whether it could be removed from B while maintaining $Area_B > T$. If t_min can be removed in this way we recolor t_min to the closest bin that is not yet full. If t_min cannot be removed without $Area_B < T$ we instead consider the largest triangle $t_{max} \in B$. We divide t_max into two smaller triangles by drawing a ray from a vertex such that one of the new triangles t_max' has area $Area_B - T$ and recolor t_max' as described above.

32nd International Symposium on Computational Geometry (SoCG 2016).
Editors: Sándor Fekete and Anna Lubiw; Article No. 66; pp. 66:1–66:2
Leibniz International Proceedings in Informatics
LIPICS Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany

3 Implementation

References

1 William Wallace and John Lowry. 'Question 269'. *New Series of the Mathematical Repository 3* (1814). Ed. by Thomas Leybourn, pp. 44–46.