Automating the Local Adaptation of Illumination in Analytical Relief Shading

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Relief Shading

Analytical

Manual

Source: reliefshading.com
Current Analytical Relief Shading

Lambertian Reflection Algorithm

Pixel gray value = 255 \times \cos(\alpha)

Source: B. Marston
Why is manual preferred?

- Locally bright and dark slopes improve legibility and aesthetic quality

- Easier and faster for the user to interpret topography

Source: reliefshading.com (left) Google Maps (right)
Why is manual preferred?

- Better for small-scale maps where contours degenerate

Source: reliefshading.com
Why aren’t there more manually shaded relief maps?

- Expense of present manual methods of production
- Time-intensive
- Requires skilled artists with good insight into cartography

Source: reliefshading.com
Diffusion Curves
Diffusion Curves

- Developed by Orzan et al. (2008)
- Vector-based primitive for creating smooth-shaded images
- Curve that diffuses colors on both sides of the space it divides

Diffusion Curves

E. Imhof manual relief shading

Reproduction using Diffusion Curves

Source: library.ethz.ch (left), B. Marston (right)
Maximum Branch Length

The longest branch length between a grid cell's flowpath and the flowpaths initiated at each of its neighbors.

Source: Lindsay, John B. and Jan Seibert. “Measuring the significance of a divide to local drainage patterns.” *International Journal of Geographical Information Science* 27, no. 7 (2013): 1453–1468 (image, left); B. Marston (image, right)
Flow Accumulation

Source: B. Marston
Vectorizing Lines
Branch Points

Shapefile
DEM

- Branch Length
- Flow Accumulation

- ridgelines
- valleylines

- Diffusion Curve Exporter

- GPU Laplacian Solver

- shaded relief
Adjusting Illumination
Deviatiion of illumination angle

Illumination - aspect

No adjustment necessary
Douglas-Peucker
Simplification for Adjusting
the Variability of Illumination
Aspect for Adjusting the Illumination Direction

Original  Low tolerance  High tolerance
Before

After
Diffusion Curves Shading
Graphical User Interface
Results
Analytical

Marston & Jenny

Source: B. Marston & B. Jenny
Manual

Marston & Jenny

Source: reliefshading.com (left), B. Marston & B. Jenny (right)
Future Work

- Improve valley floor extraction

Source: B. Marston
Future Work

- Network analysis
- Adjust illumination and detail according to scale
- Incorporate hypsometric tinting
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Thank you

Questions?
References


References


