# Creating Personalized Jigsaw Puzzles

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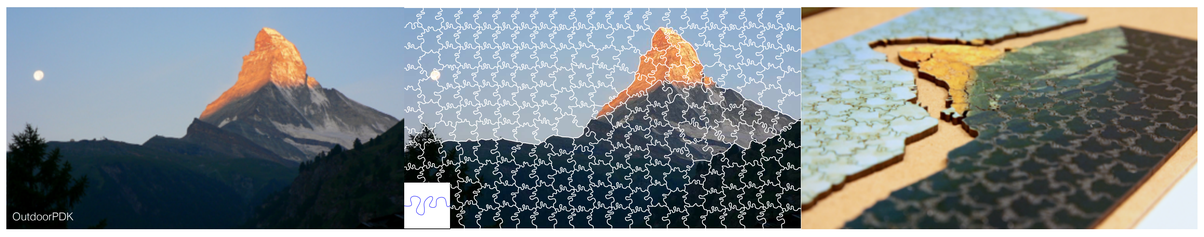
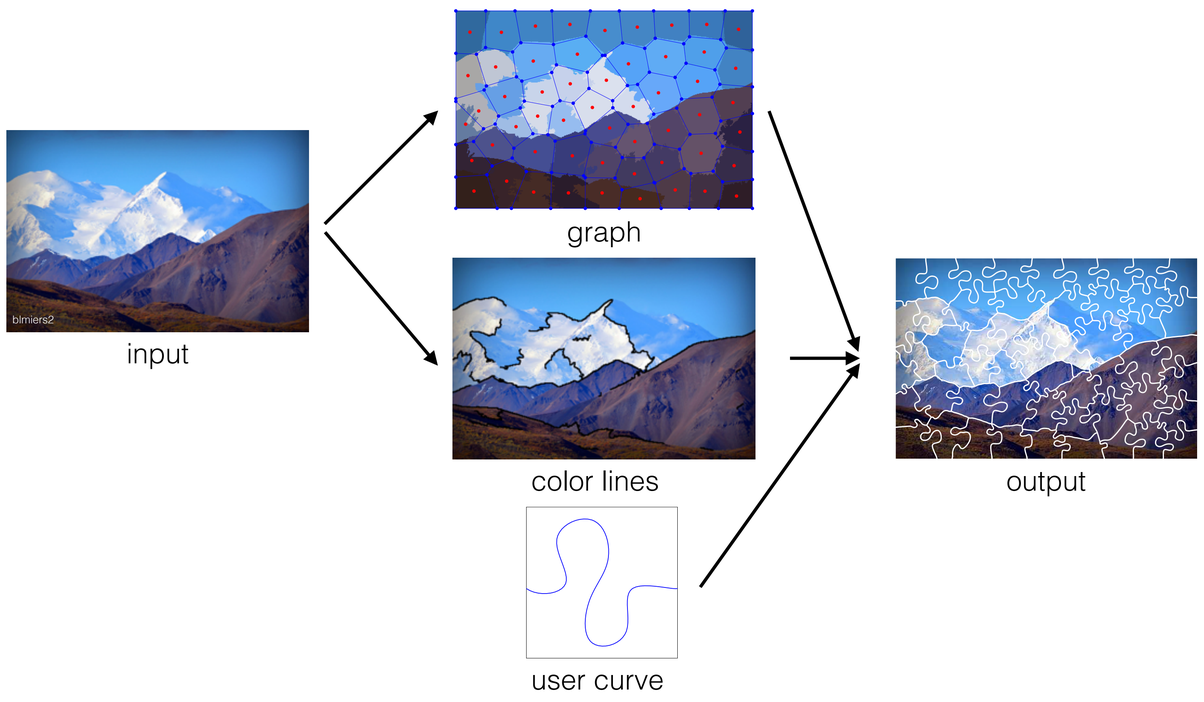
Images courtesy of Wikipedia and Flickr users: Arches National Park (Neal Herbert), Ed Yourdon, Nattu, OutdoorPDK, pelymo_05, R. J. Malfalfa, Sebastiàn Dario, skoeber

## ABSTRACT

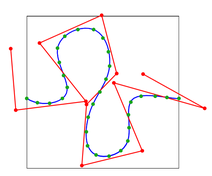


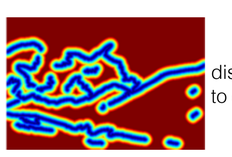

We present a method for creating custom jigsaw puzzles based on the image content and a user-defined curve. We optimize for puzzle cuts that follow the color contours in the image and match the user curve, creating aesthetically interesting puzzles that we can fabricate with a laser cutter.

## METHOD




Optimize puzzle cut for each edge in graph.




$$\text{minimize} \quad \left\|\mathbf{B'x} - \mathbf{B'x}_u\right\|^2 + \lambda \sum_{i=1}^{n_s} \mathbf{I}(\mathbf{B}_i\mathbf{x})$$

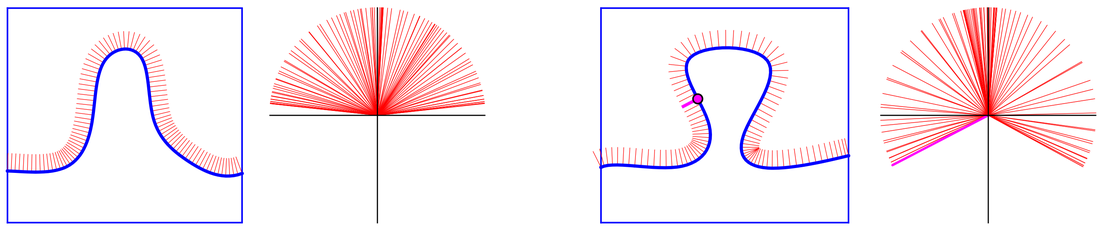
match user curve (1st derivative) — follow color lines

$$\text{subject to} \quad \mathbf{Ax} < \mathbf{b}$$

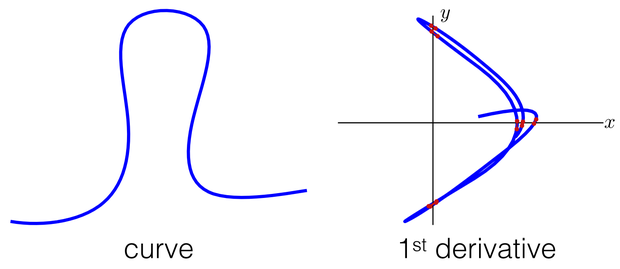
linear constraints: interlocking, intersection, min piece size, min width

Post-process: eliminate self-intersections, ensure minimum width.

## INTERLOCKING CONSTRAINT



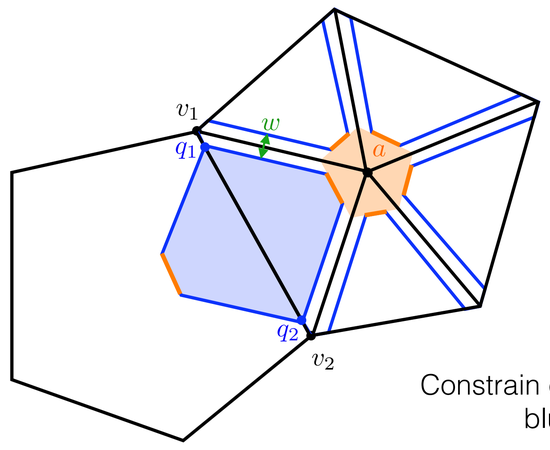
not interlocking — interlocking




curve — 1st derivative

Constrain axis crossings of 1st derivative.

## INTERSECTION, MIN PIECE SIZE CONSTRAINT

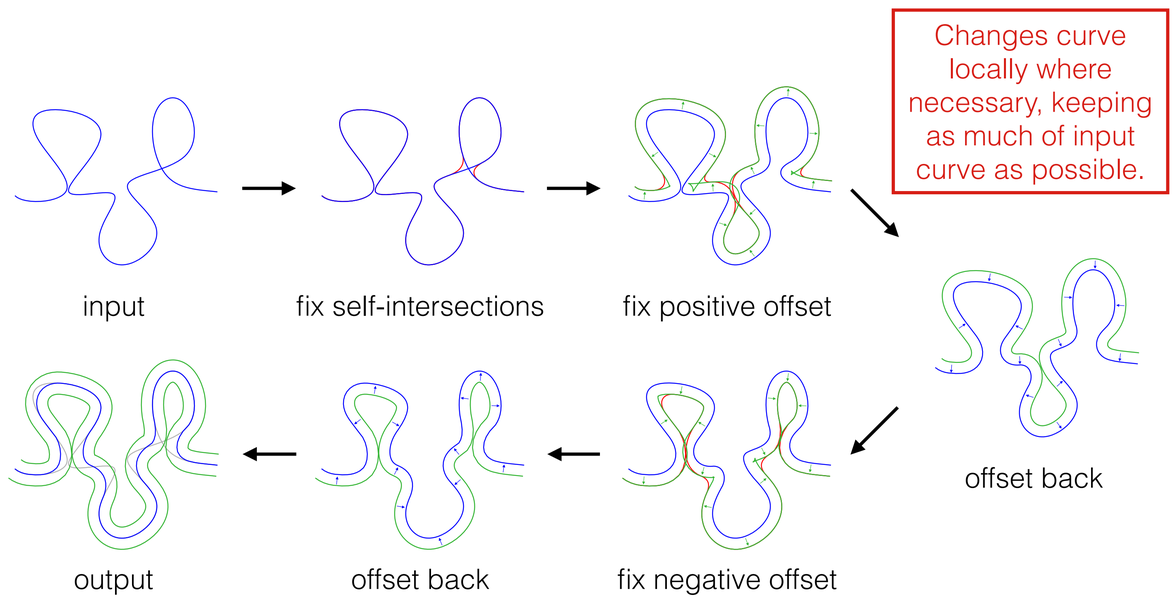



min piece size $a$

min width $w$

Constrain curve on edge $(v_1, v_2)$ to blue shaded area.

## SELF-INTERSECTION, MIN WIDTH CONSTRAINT

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