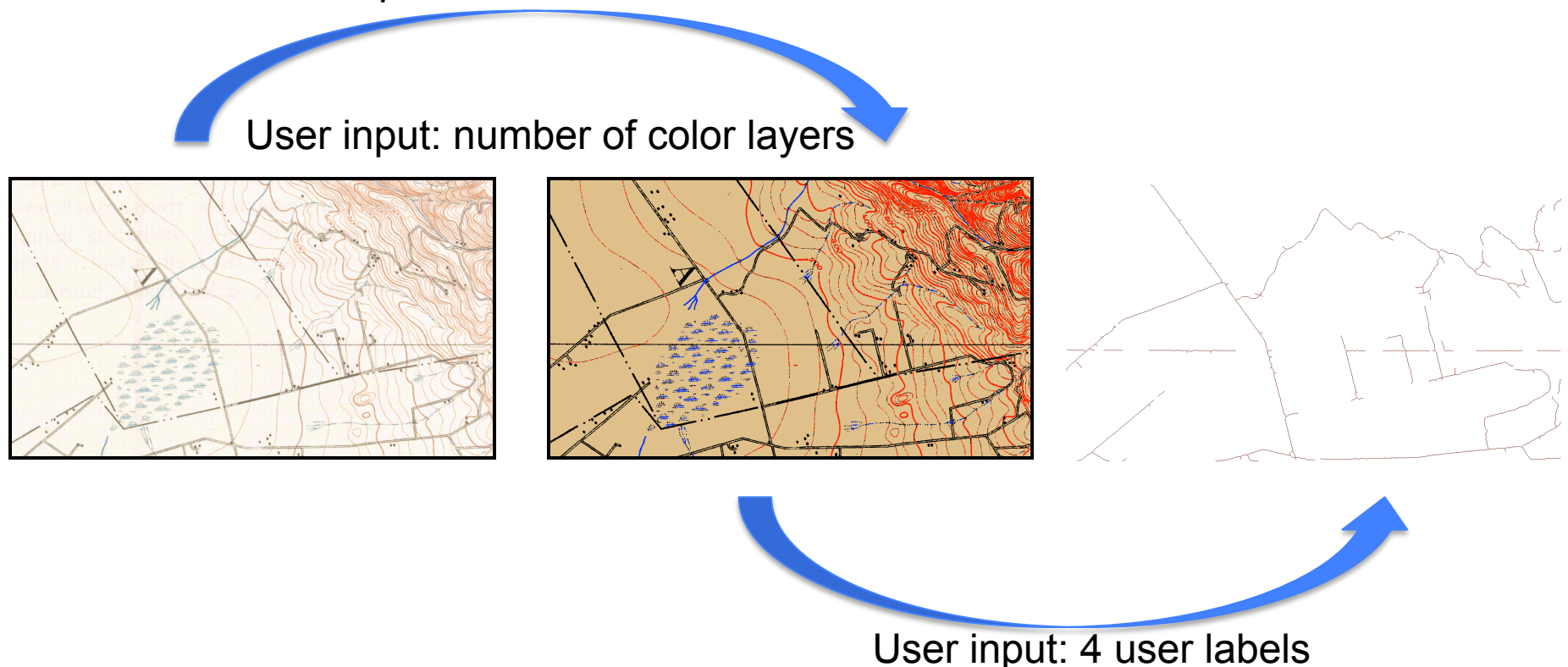


Integrating Color Image Segmentation and User Labeling for Efficient and Robust Graphics Recognition from Historical Maps

Summary: the integration of a Color Image Segmentation (CIS) step with an interactive road-layer extraction process that consists of an image cleaning and a vectorization step.



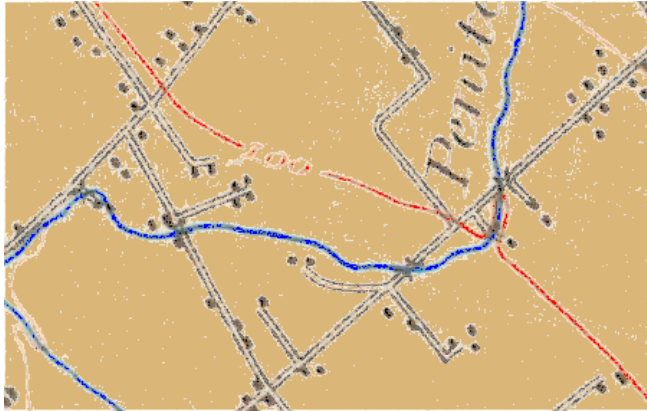
Historic USGS Topographic Maps

- National map series (1895-1945): buildings, roads, railways, elevation, hydro, wetlands, text
- Imperfect quality of scans of archived paper products
- Map objects in different colors

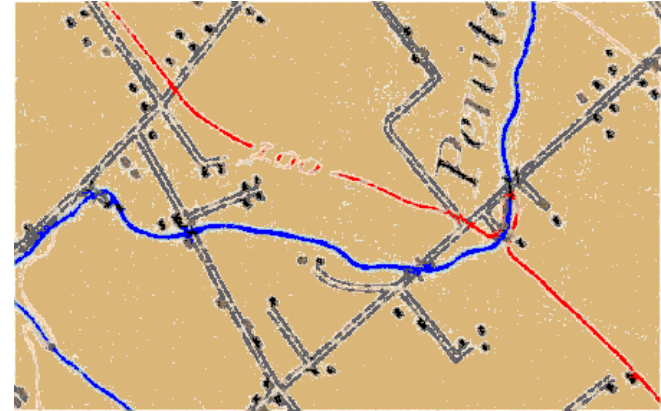


Color Image Segmentation

Determining initial color seeds using global color layer prototypes



Identifying homogeneous regions (plane) of different color layers



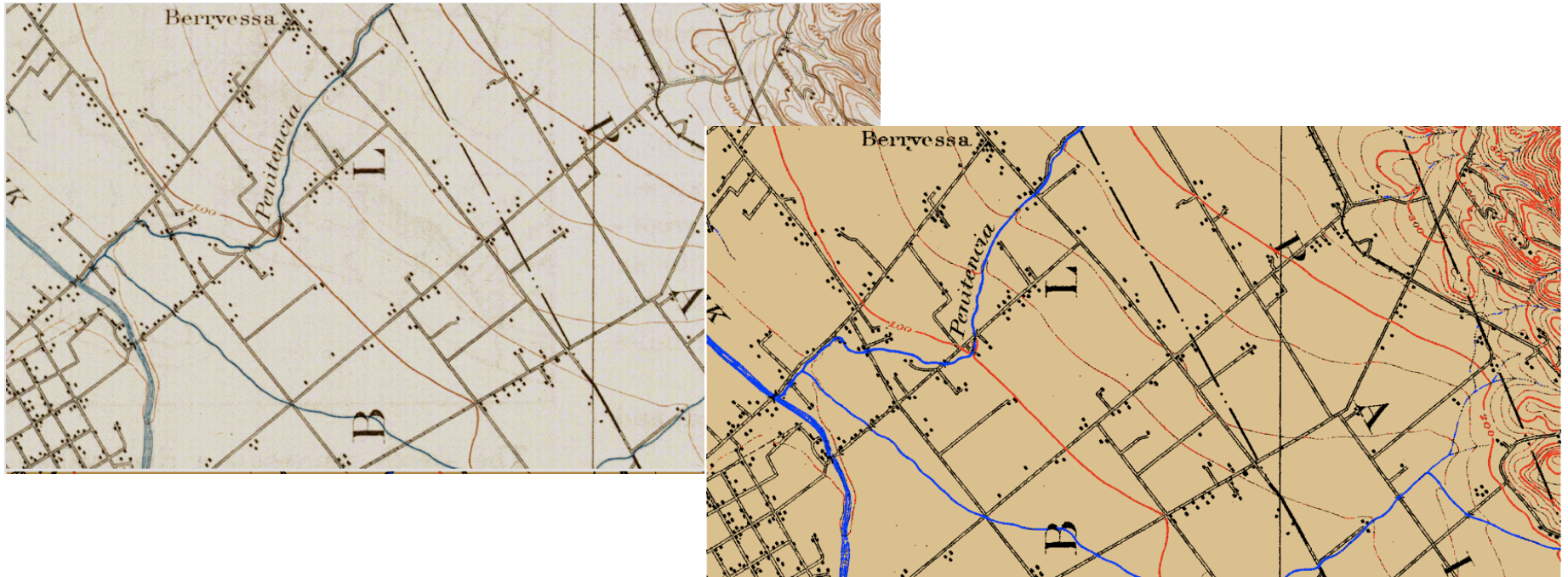
Prototype adjustment: Local color sampling along margins of homogeneous areas



Final segmentation using constrained region growing and connectivity tests



CIS Results in Low-Quality Maps

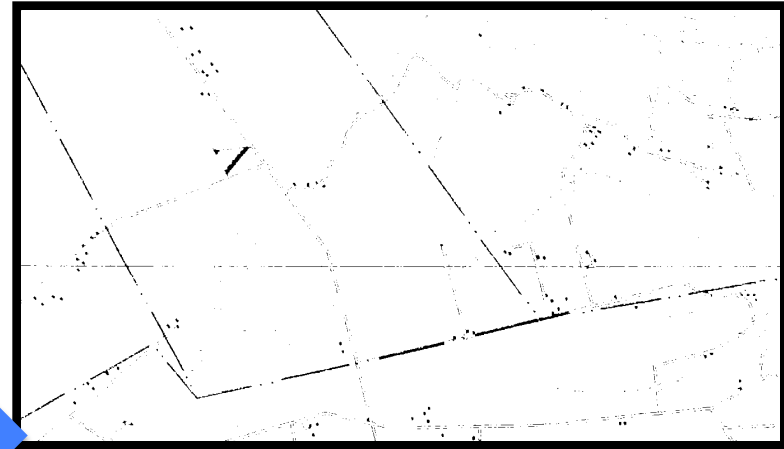


- Successful and robust separation of color layers
- Only input parameters: map layer color extremes (Red: 255,0,0 in RGB color space)
- Limitations: Remaining merging effects (dense elevation contours and roads), and mixed colors at intersections
- Rigid performance test: “Raw and unrepaired” segmentation as input to cleaning and the road vectorization

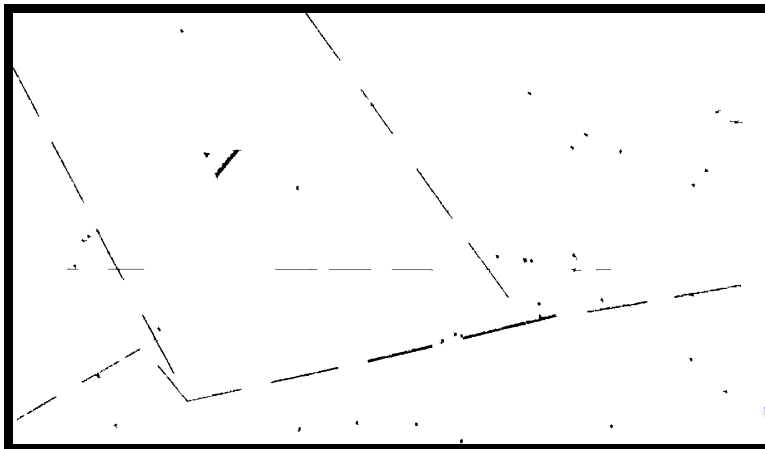
Interactive Cleaning



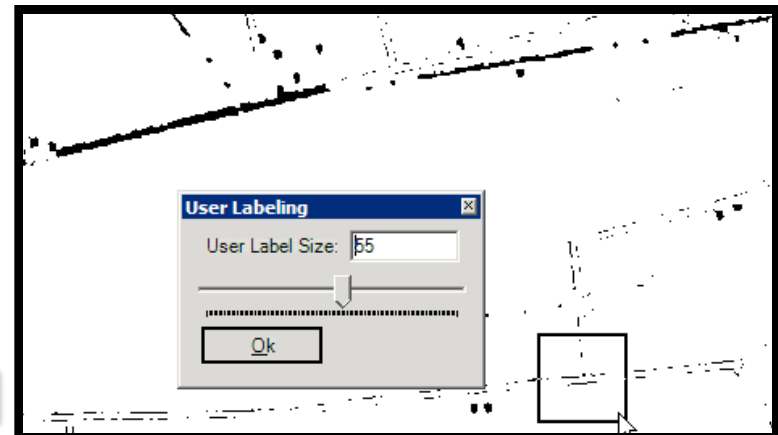
Input for the cleaning process



Erosion operator to remove most road pixels



Large noise objects i.e., thicker than road lines

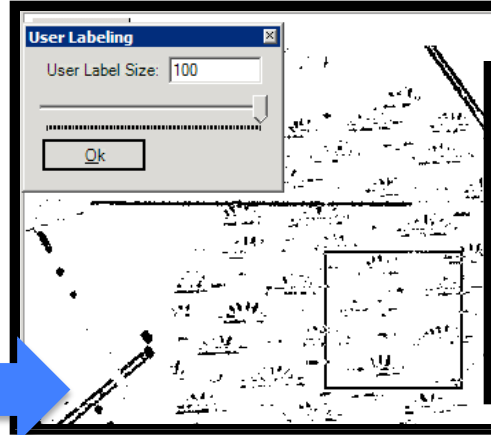


User provides examples of remaining road pixels

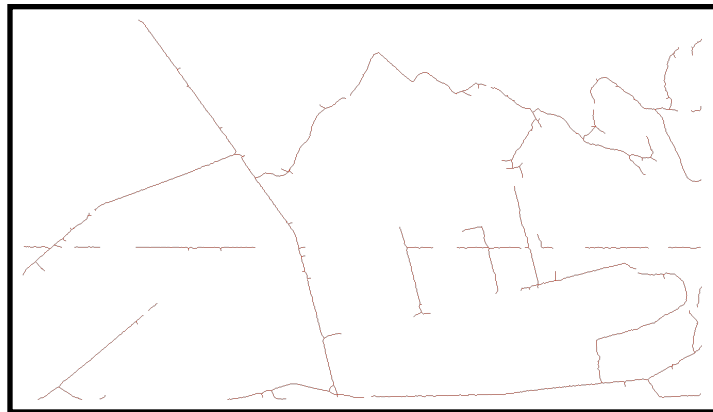
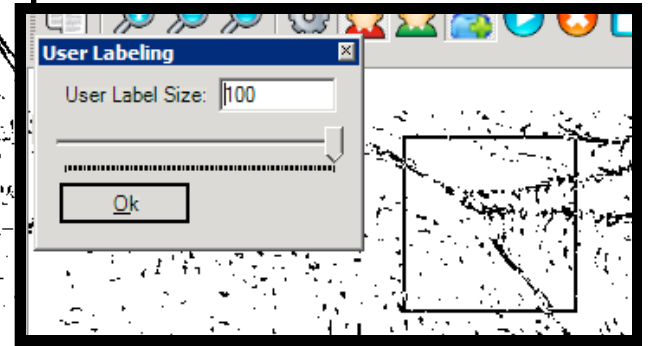
Interactive Cleaning (Cont'd)



Large noise objects are removed



User provides examples of small noise objects



Raw road vectorization results



Cleaning result: noise objects are removed