Supplementary material

In this section, we show more comparisons of our results with Bezier's results in the real case as mentioned in Section 4.4. Then, we conducted shoreline filling experiments to further verify the adaptability of the model with different types of polylines.

A. Comparison in Scenario 1 and Scenario 2

As presented in Section 4.3, the results of Bezier curve model depend on the parameters, and the parameter $n = 40$ is recommended in our case. Therefore, we set the parameter n=40 for Bezier curve model to conduct the curve filling experiment to compare with our model. The comparisons of the filling results of our model and the Bezier curve model in Scenario 1 and Scenario 2 are shown in Figure 1 and Figure 2, respectively.

In Scenario 1, that is, filling the polylines with gaps on the historical map, our model can adaptively generate significant bends and recover the shape of the polyline that is closer to the truth values than Bezier model. For all polylines from Figure 1a to Figure 1f, our model can generate smooth filling results with continuous changes in curvature. However, the performance of Bezier model is usually limited by the parameter. For example, for the polylines in Figure 1a and Figure 1b, Bezier results are not bended enough regarding the truth result on the historical map. But for the polylines in Figure 1c to Figure 1f, Bezier results are over bended regarding the truth result, and even show some obvious inappropriate sharp angularities. The similar conclusion can be drawn in the trace filling experiment: our results are smoother, while Bezier results show inappropriate sharp angularities (Figure 2).

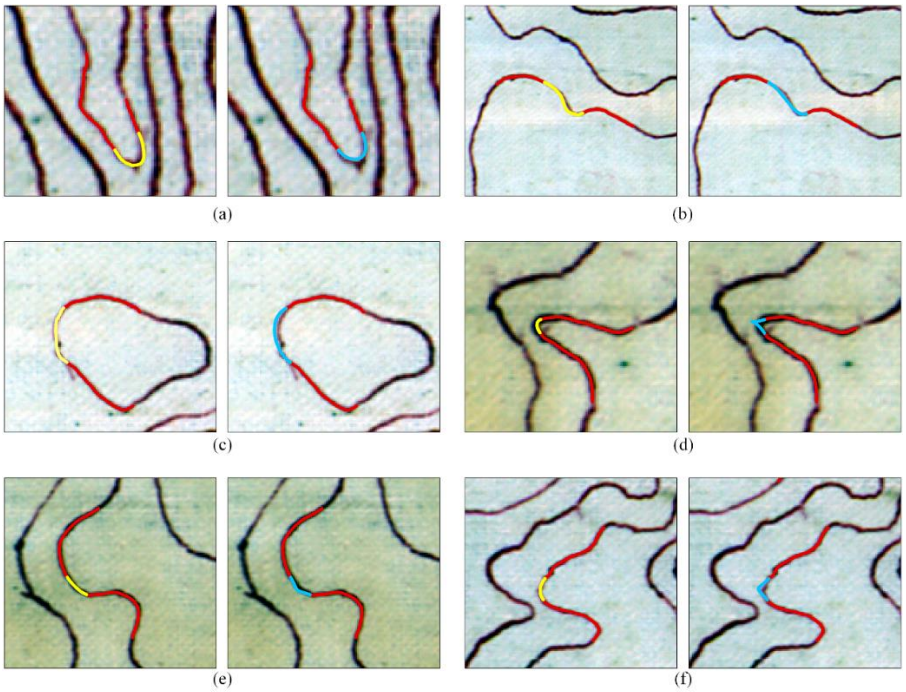

Figure 1. Comparisons of the filling results of our model and the Bezier curve model for the automatic vectorization of polylines on a historical map. In each sub-figure (a-f), from left to right: overlay of our results and the map, overlay of Bezier results and the map. Source lines, our results and Bezier results are displayed in red, yellow and blue, respectively.

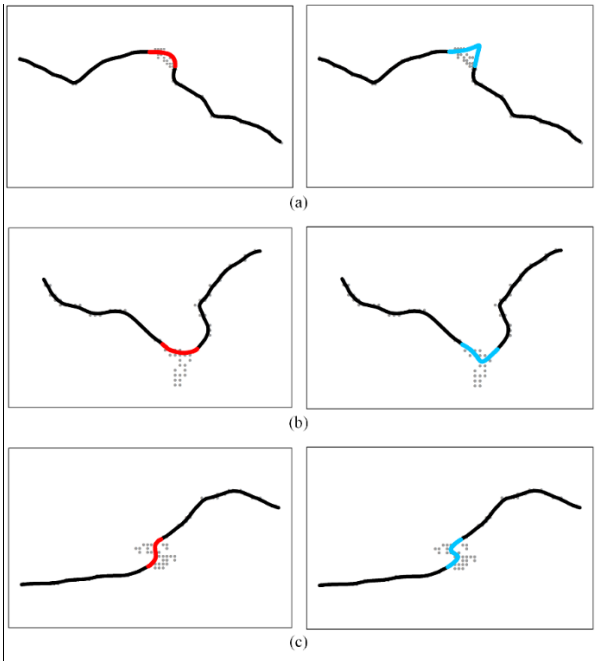

Figure 2. Comparisons of the filling results of our model and the Bezier curve model for the main traces with gaps. In each sub-figure (a-c), from left to right: overlay of our results and the trace points, overlay of Bezier results and the trace points. Source lines, our results and Bezier results are displayed in black, red and blue, respectively.

B. Application scenario 3--Filling gaps in the coastline

In this section, we conducted the gap-filling experiment on coastline data to further demonstrate the performance of our model. The experiment collected the data from the Chesapeake Bay, which is a typical ria coastline that lies off the Atlantic Ocean, surrounded by Maryland and Virginia in the United States. The data is part of the Global Self-consistent Hierarchical High-resolution Geography Database (GSHHG) which is collected by National Oceanic and Atmospheric Administration (NOAA) (https://ngdc.noaa.gov/mgg/shorelines/shorelines.html). We randomly set gaps along the coastline as our source data, and generated samples as described in Scenario 1. We also conducted experiments using Bezier model, and the comparison of results was shown in Figure 3. The results further proved that our model can generate the curve content adaptively with a high similarity with the truth value. The performance of Bezier model was limited by the parameters and the result had a low similarity with the truth value.

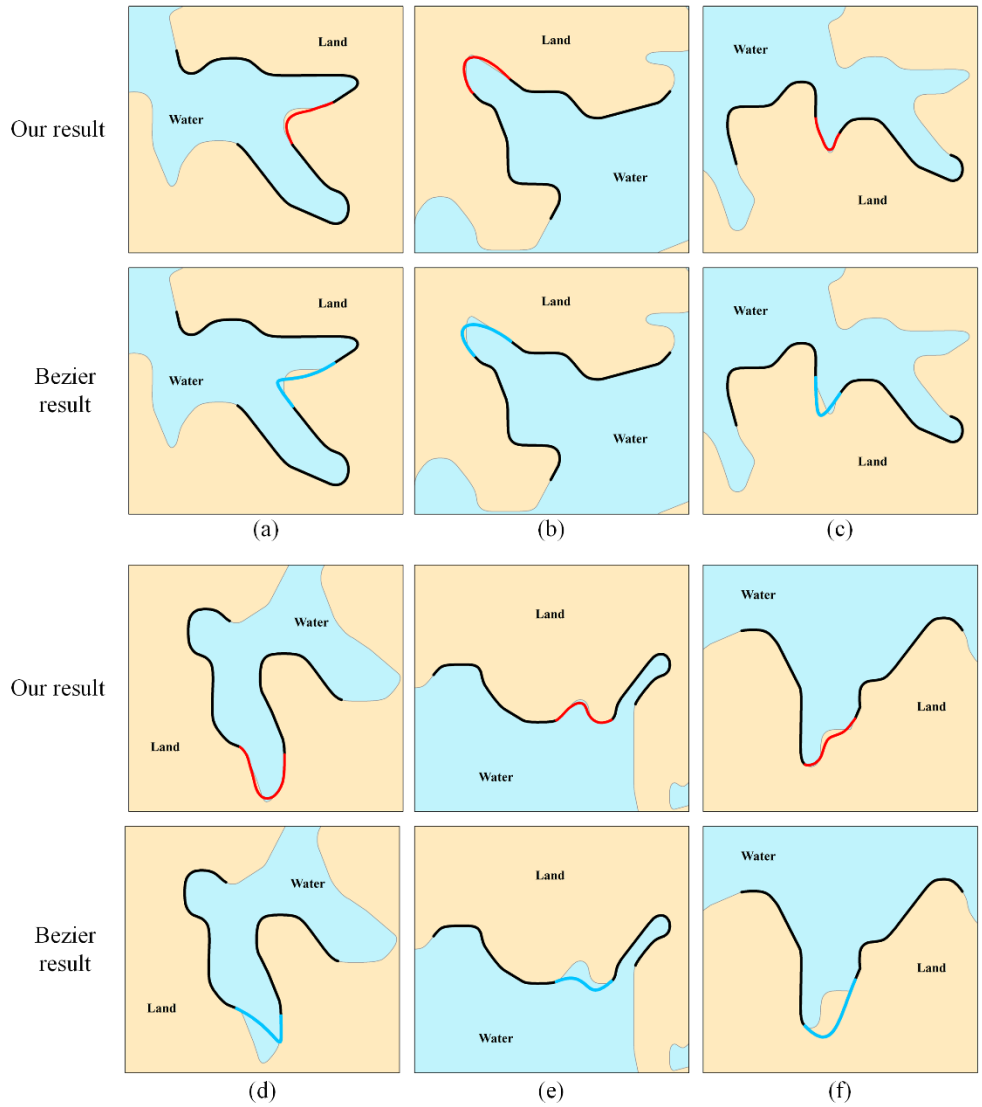

Figure 3. Comparisons of the filling results of our model and the Bezier curve model for the coastlines with gaps. Source lines, our results and Bezier results are displayed in black, red and blue, respectively.