Supplementary Material for "Jacobi Set Simplification for Tracking Topological Features in Time-Varying Scalar Fields"

Dhruv Meduri, Mohit Sharma and Vijay Natarajan

Abstract

This document provides additional implementation details, a table listing parameter values used in the implementation, and statistics on the Jacobi sets pre- and post-simplification for different datasets in the paper "Jacobi Set Simplification for Tracking Topological Features in Time-Varying Scalar Fields".

1 Simplified Jacobi set

Figure 1(a) shows a few critical points within the gradient magnitude fields G_t and G_{t+1} in two consecutive time steps. The critical points are clustered into δ-sublevel set components C_1 and C_2. As mentioned in Section 7 of the paper, the spatial overlap based tracking filter in TTK, called "Tracking from Overlap" [1] is utilized to identify overlapping components in the adjacent time steps. The critical points enclosed in the individual components are replaced by their centroid, serving as a single node in the simplified Jacobi set. The Jacobi edges passing through overlapping δ-sublevel set components in adjacent timesteps are replaced by a single arc passing through the centroids of the sublevel set components. Figure 1(b) shows arcs of the simplified Jacobi set resulting from the above-mentioned procedure.

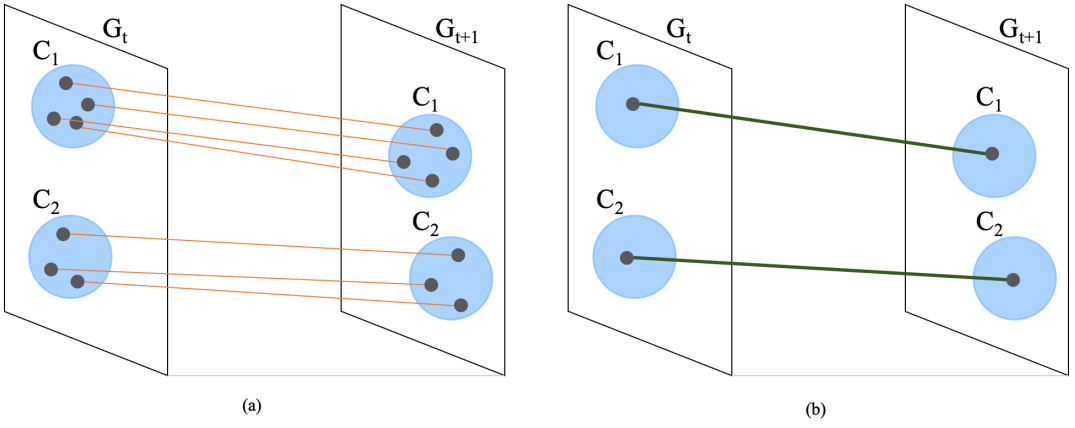

Fig. 1: Jacobi set simplification. (a) Two components of δ-sublevel set, C_1 and C_2, for gradient magnitude field G_t and the δ-sublevel set components in $G_(t+1)$ that have a spatial overlap with the former. Jacobi edges (orange) connect critical points lying within C_1 and C_2. (b) Simplified Jacobi set computed by replacing all orange edges with a single edge (green).

2 Track statistics

TABLE 1: Track statistics and parameter thresholds. The number of edges of the Jacobi set reduces significantly post simplification, resulting in a clean and clutter-free visualization. The number of tracks #JT-SP in Boussinesq is 38 (large) + 214 (medium) + 60 (short). Parameter thresholds are chosen conservatively, higher values would also work. (#JE: Jacobi edges, #JE-S: Jacobi edges after simplification, #JT-S: Jacobi tracks after simplification, #JT-SP: Jacobi tracks after post-processing)

Dataset	#JE	#JES	#JT-S	#JT-SP	$\varepsilon_p(\%)$	$\delta(\%)$	ε_t	ε_s	ε_l
Rotating Gaussians	2283031	897	3	-	0.95	23	-	-	-
von Kármán vortex street	13242297	33206	610	57	0.12	0.13	50	11	150
Boussinesq	41912203	73101	4597	312	7.00	0.75	200	11	{50,750}
Sea surface height	1051267	8894	4624	27	0.20	0.02	25	7	300

REFERENCES

[1] J. Lukasczyk, G. Weber, R. Maciejewski, C. Garth, and H. Leitte, "Nested tracking graphs," *Comput. Graph. Forum*, vol. 36, no. 3, pp. 12–22, 2017.