A Appendix

A.1 Detailed Hyperparameter Configurations

Table 1: Detailed Hyperparameter Configurations for ViSTSAD. L denotes the window size, τ the step size, and ℓ the sub-window length. The thresholds δ_1 and δ_2 correspond to the residual augmentation thresholds for the six types of relationship matrices.

Dataset	L	τ	ℓ	Group O Matrices						Group C Matrices					
				$\overline{G}_O^o$		$\overline{G}_O^d$		$\overline{G}_O^v$		$\overline{G}_C^o$		$\overline{G}_C^d$		$\overline{G}_C^v$	
				δ_1	δ_2	δ_1	δ_2	δ_1	δ_2	δ_1	δ_2	δ_1	δ_2	δ_1	δ_2
ATSADBench	32	32	7	0.45	0.50	0.45	0.50	0.45	0.50	0.75	0.80	0.75	0.80	0.75	0.80
SKAB Sub-datasets															
SKAB (1.csv)	64	64	16	1.0	1.0	0.56835	0.56836	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SKAB (3.csv)	64	64	16	1.0	1.0	1.0	1.0	0.51963	0.51964	1.0	1.0	1.0	1.0	1.0	1.0
SKAB (8.csv)	64	64	16	1.0	1.0	1.0	1.0	1.0	1.0	0.80475	0.80476	1.0	1.0	1.0	1.0
SKAB (other-2.csv)	64	64	16	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.44818	0.44819
SKAB (other-5.csv)	64	64	16	0.90947	0.90948	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SKAB (other-6.csv)	64	64	16	0.64159	0.64160	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SKAB (other-7.csv)	64	64	16	0.70263	0.70264	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SKAB (other-9.csv)	64	64	16	0.80081	0.80082	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SKAB (other-10.csv)	64	64	16	0.39950	0.39951	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SKAB (other-12.csv)	64	64	16	0.70021	0.70022	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SKAB (other-14.csv)	64	64	16	0.73588	0.73589	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Table 2: Hyperparameter configurations for the three baseline methods: Direct, Prediction-based, and Anomllm.

Method	Dataset	window size (L)	step size (τ)	prediction horizon (H)
Direct	ATSADBench	10	10	-
	SKAB	64	64	-
Prediction-based	ATSADBench	20	5	5
	SKAB	64	64	64
Anomllm	ATSADBench	32	32	-
	SKAB	64	64	-

A.2 Details of Grayscale Representation in the Preliminary Study

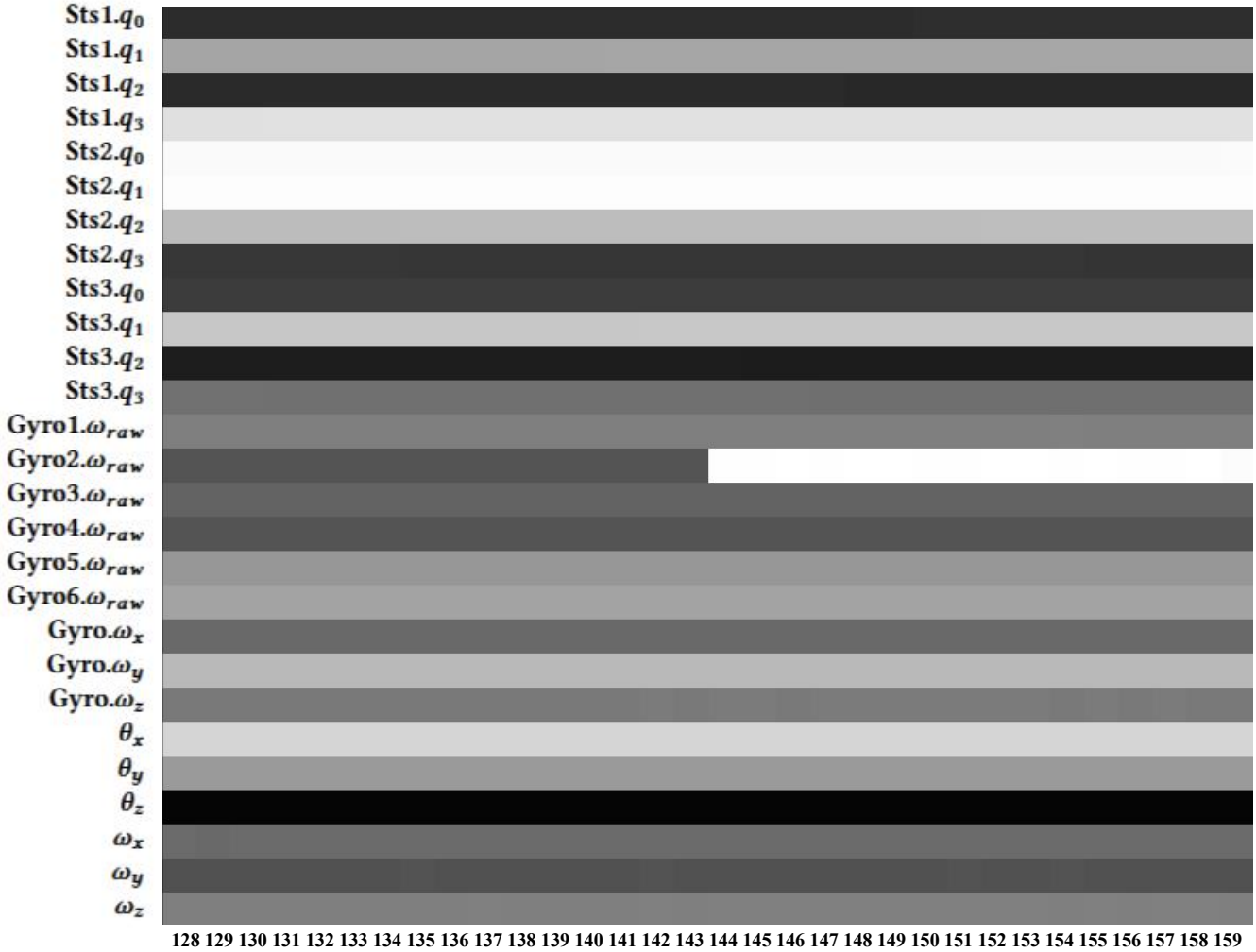

Figure 1: Grayscale representation of all variables (Window 5: 128s~159s)

A.3 Time-varying features in Example 1 (Window 6: 160s~191s)

Figure 2: Original Observed Window

Figure 3: First-order Difference Window

Figure 4: Rolling Variance Window

A.4 Details of Residual Graph Before and After Soft-thresholding in Example 2 (Window 6: 160s~191s)

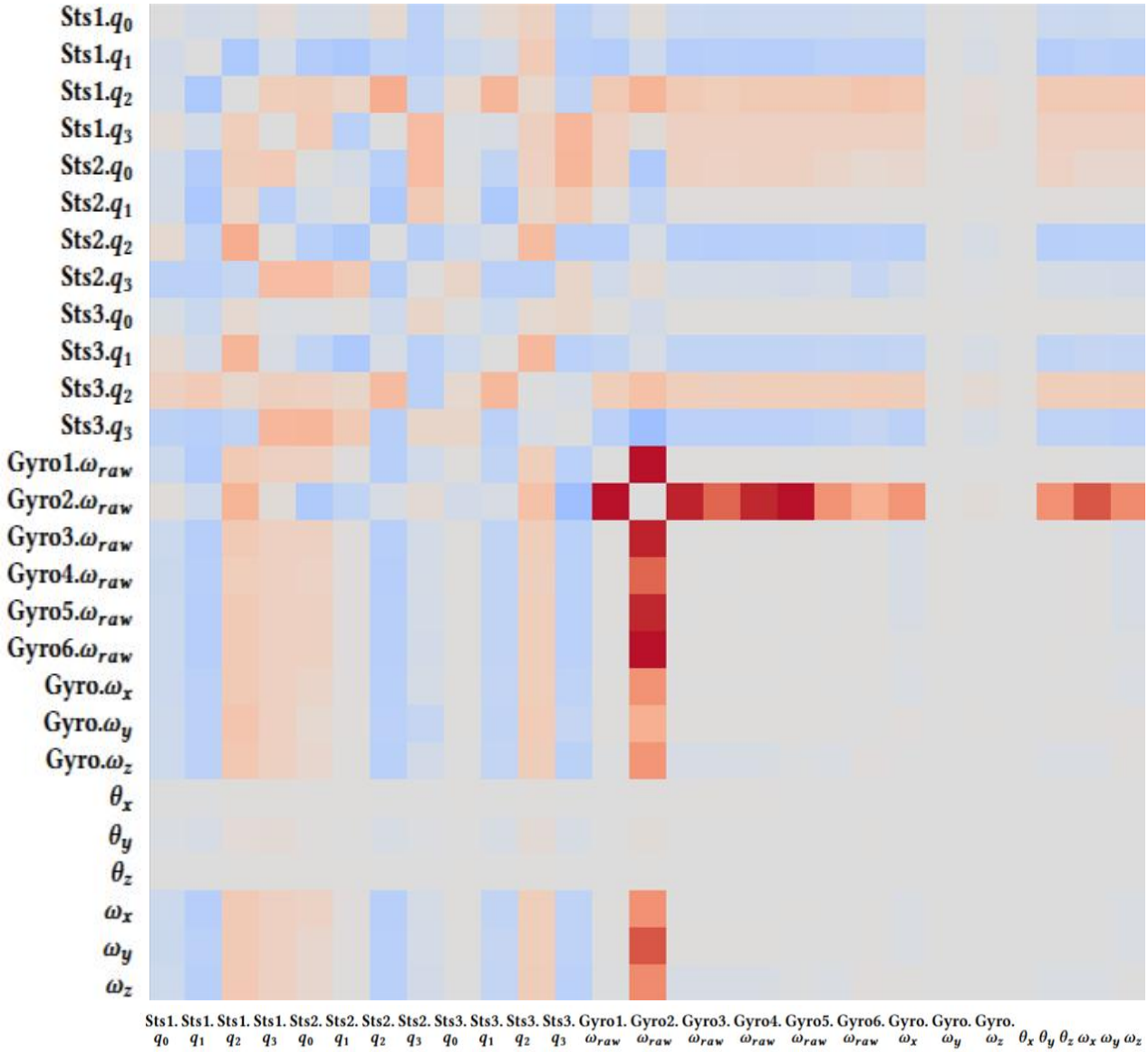

Figure 5: Before soft-thresholding

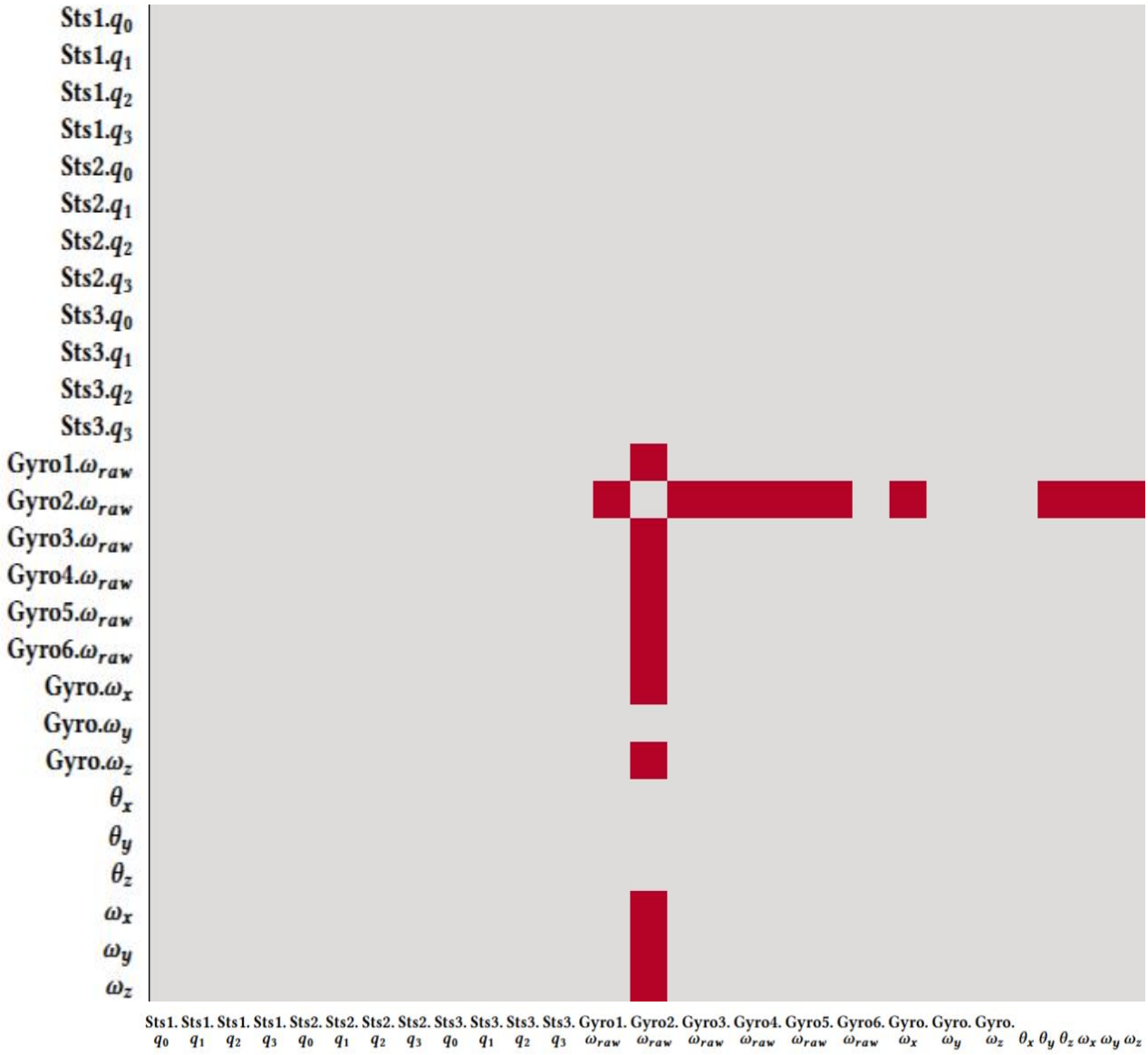

Figure 6: After soft-thresholding