



Slope Entropy Characterisation: Is The Interval For Quasi--Null Gradients Really Necessary?



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Summary

A study to assess the necessity of the 0 symbol, representation of ties, in the calculation of the recently proposed Slope Entropy(SlpEn) method. The results confirm the complete implementation of SlpEn achieves a higher classification accuracy.

Introduction

- Use a varied and diverse experimental datasets to characterize the classification performance of SlpEn in its standard form and when symbol 0 is removed.
- Use also Permutation Entropy(PE) for comparative purposes.

Materials and Methods

- SlpEn is based on the symbolic representation of differences between consecutive samples in time series.
- In this work seven datasets have been used, including biomedical and industrial time series.
- A comparative analysis among standard SlpEn, simplified SlpEn, and standard PE.

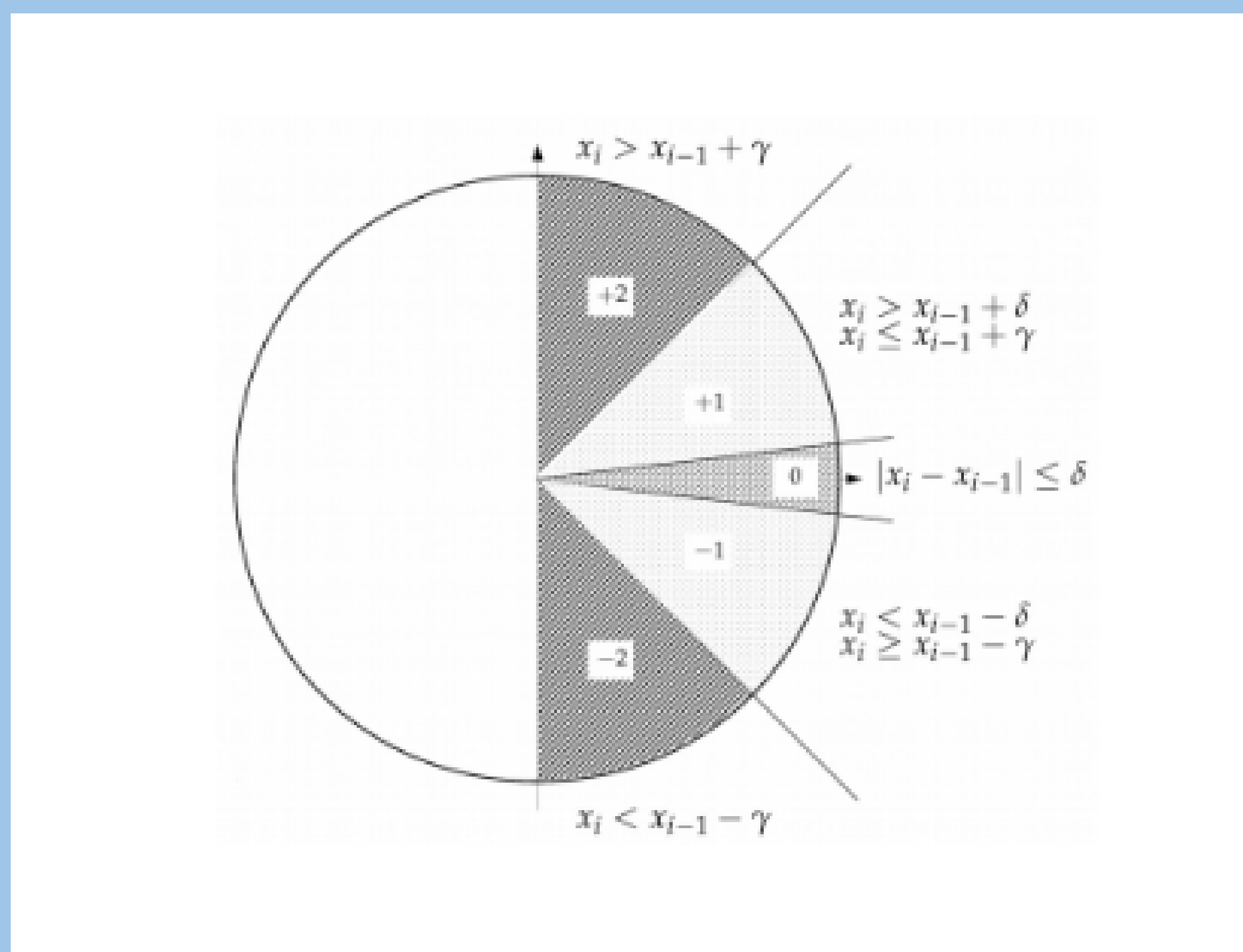


Fig 1: The original SlpEn.

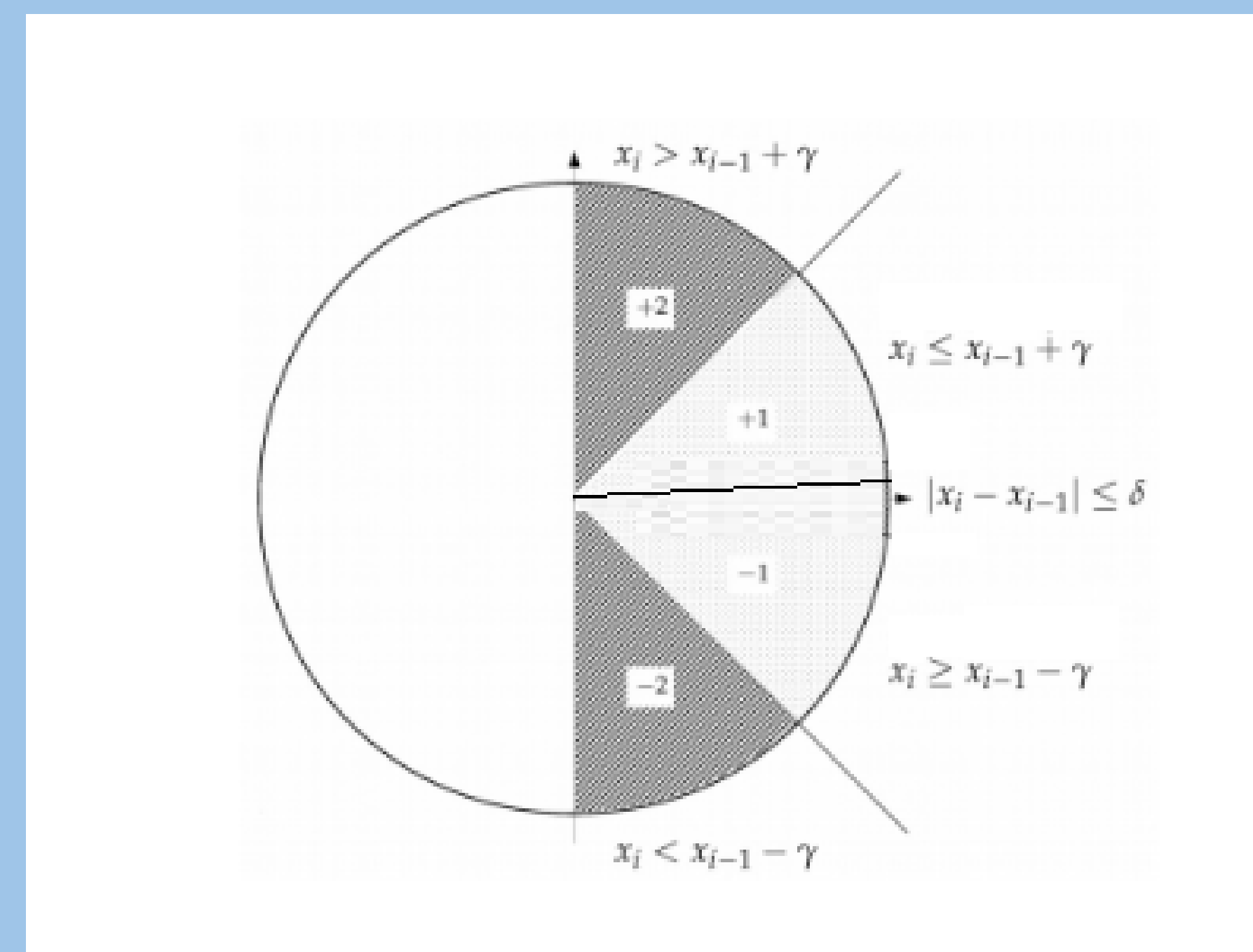


Fig 2: The modified SlpEn.

Results

Datasets	Bern-Barcelona EEG			Fantasia			FordA			House Twenty			PAF Prediction			Worms TwoClass			BonnEEG		
Values	SlpEn $m = 7$ $\gamma = 0.2$ PE $m = 6$			SlpEn $m = 5$ $\gamma = 0.5$ PE $m = 6$			SlpEn $m = 5$ $\gamma = 0.5$ PE $m = 5$			SlpEn $m = 4$ $\gamma = 0.2$ PE $m = 7$			SlpEn $m = 7$ $\gamma = 0.3$ PE $m = 6$			SlpEn $m = 6$ $\gamma = 0.35$ PE $m = 6$			SlpEn $m = 7$ $\gamma = 0.25$ PE $m = 3$		
Ties	FA = 0% NA = 0%			Old = 8% Young = 3%			1 = 0% 2 = 0%			1 = 25% 2 = 22%			even = 6% odd = 19%			1 = 4% 2 = 6%			F = 4% S = 1%		
Original Ties	78%	75%	61%	86%	76%	65%	82%	82%	74%	83%	63%	61%	80%	71%	58%	70%	67%	68%	84%	81%	90%
10%	50%	51%	61%	81%	76%	60%	-	61%	72%	-	-	-	-	-	-	61%	63%	68%	73%	73%	86%
15%	-	-	-	80%	75%	60%	-	58%	71%	-	-	-	-	-	-	60%	62%	68%	74%	74%	84%
20%	-	-	-	80%	73%	62%	-	-	-	-	-	-	-	-	-	60%	62%	67%	74%	75%	80%
25%	-	-	-	76%	72%	63%	-	-	-	-	-	-	54%	75%	67%	59%	62%	67%	74%	75%	80%
30%	-	-	-	72%	69%	63%	-	-	-	80%	54%	71%	-	75%	68%	59%	62%	67%	74%	78%	74%

Discussion and Conclusion

The complete SlpEn method achieves a higher accuracy in most cases compared to the simplified version and PE. It is not advisable to remove the 0 symbol from the SlpEn calculation.