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Investigation of Hierarchical Temporal Memory Spatial Pooler's Noise Robustness and Specificity

Sang Nguyen
phuocsangnguyen97@gmail.com

Duy Nguyen
ngthanhduy7@gmail.com

Fachbereich 2 Informatik und Ingenieurwissenschaften

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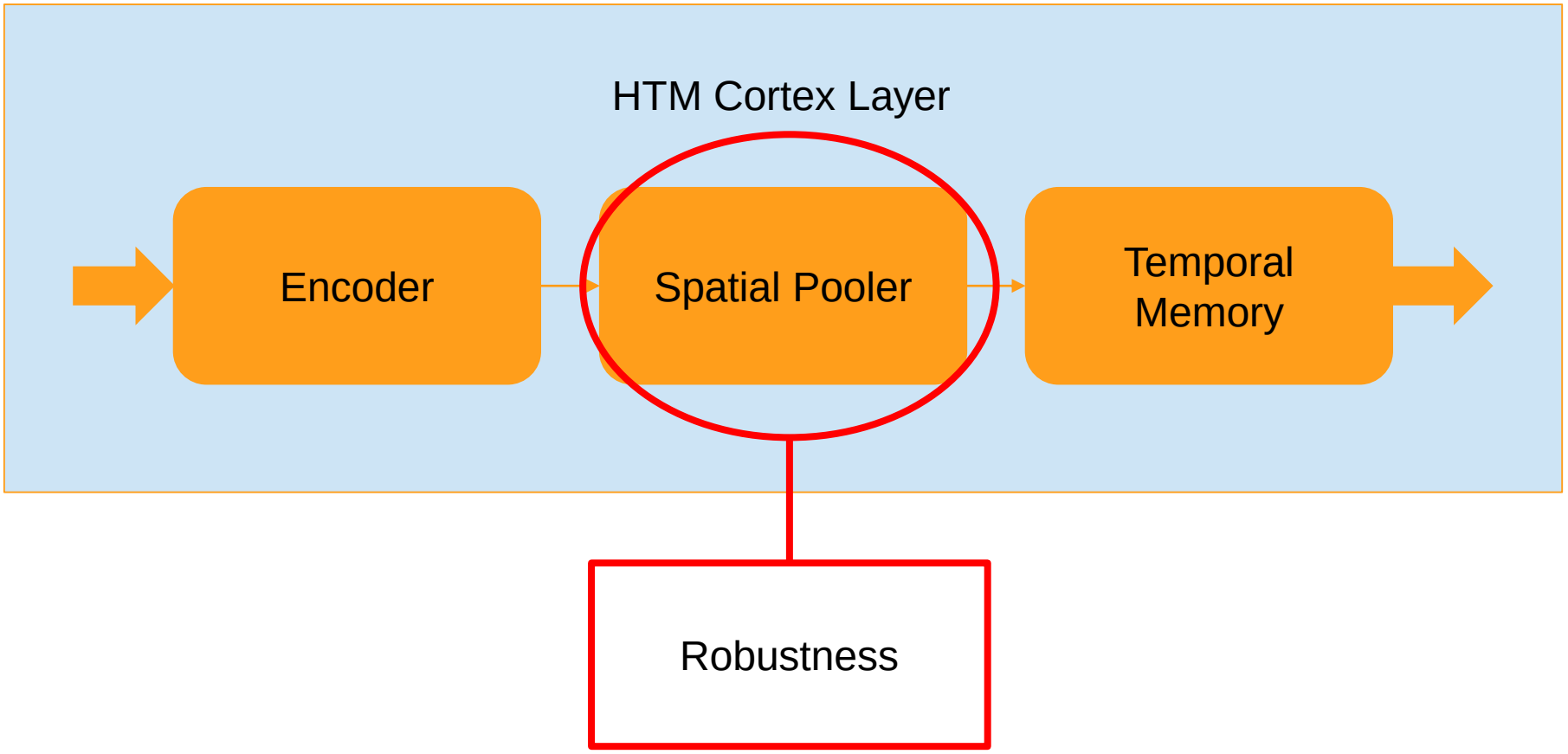
Introduction



Introduction

Specificity - the ability to differentiate between two different inputs

Methods

$$f(x) = 10 \cdot \cos(0.01\pi \cdot x) \cdot \cos(0.05\pi \cdot x)$$

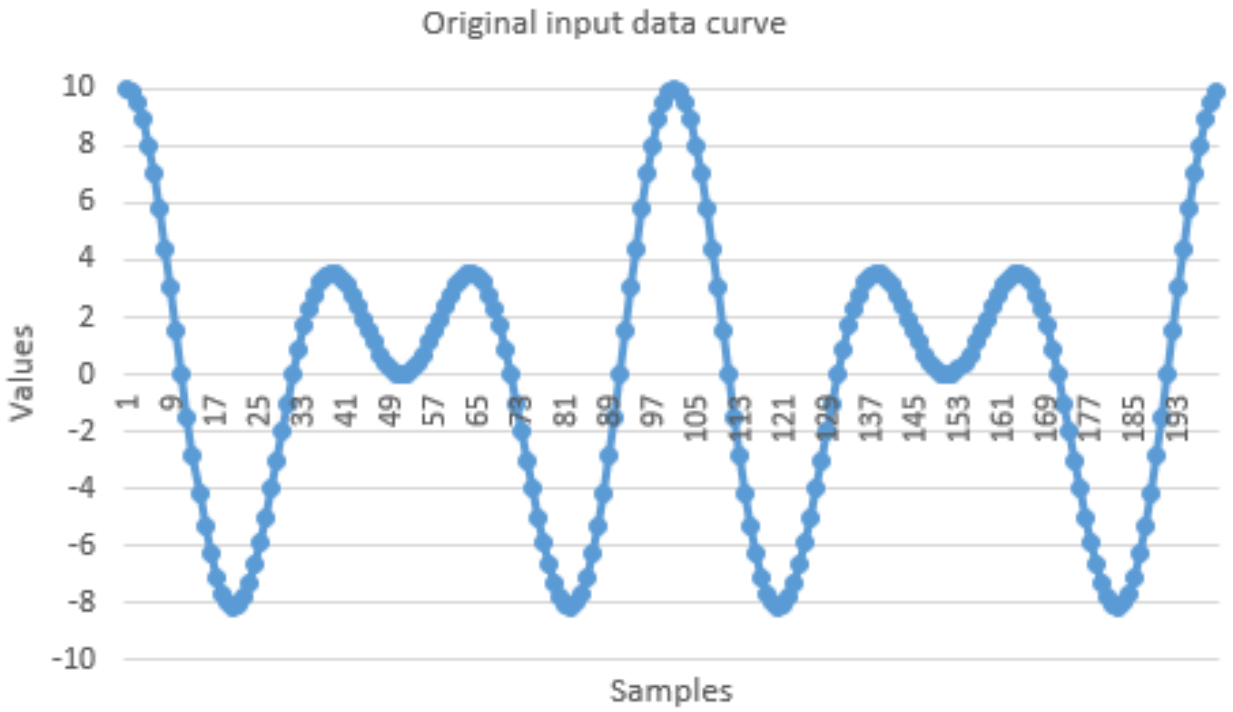


Figure 1. The first 200 samples from the original input data set

Methods

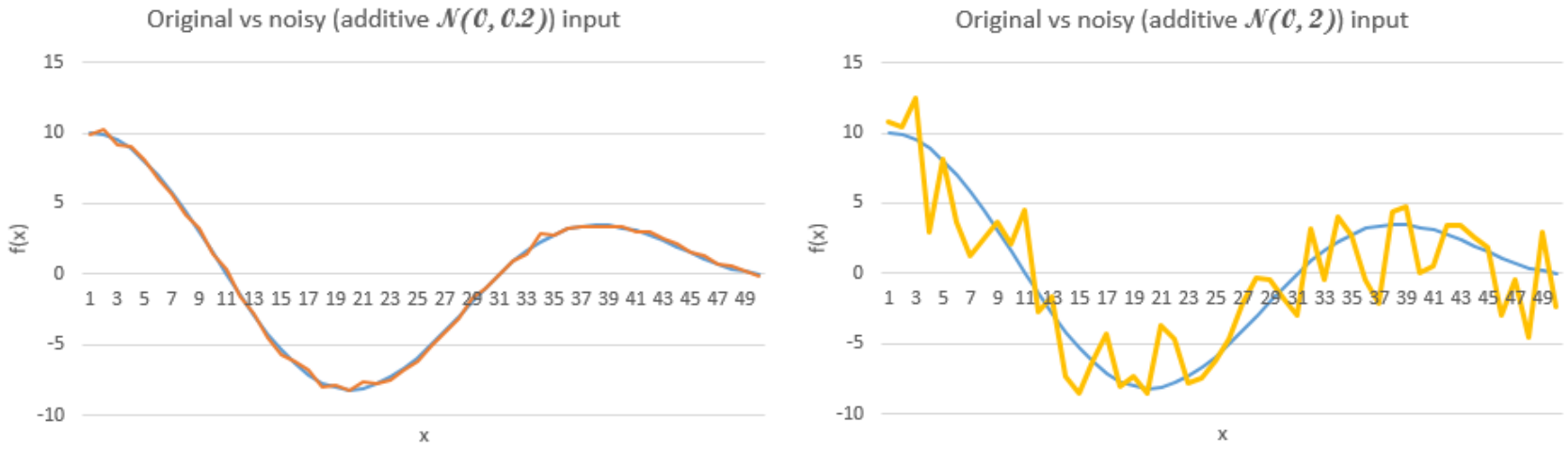


Figure 2. Comparison between original and noisy input data sets

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Methods

Table 1. Scalar Encoder's Settings

Parameter	Value
W	65
N	465
MinVal	-20.0
MaxVal	20.0
Periodic	false
ClipInput	true
Offset	108

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Methods

Table 2. Spatial Pooler's Settings

Parameter	Value
inputDimensions	465
comlumnsDimension	2048
potentialRadius	-1
potentialPct	1
globalInhibition	true
numActiveColumnsPerInhArea	0.02*2048 (2%)
stimulusThreshold	0.5
synPermInactiveDec	0.008
synPermActiveInc	0.01
synPermConnected	0.1
dutyCyclePeriod	100
maxBoost	10

Methods

Comparison function

```
public static double GetHammingDistance(int[] originArray,
int[] comparingArray, bool countNoneZerosOnly = false)
```

Result and Discussion

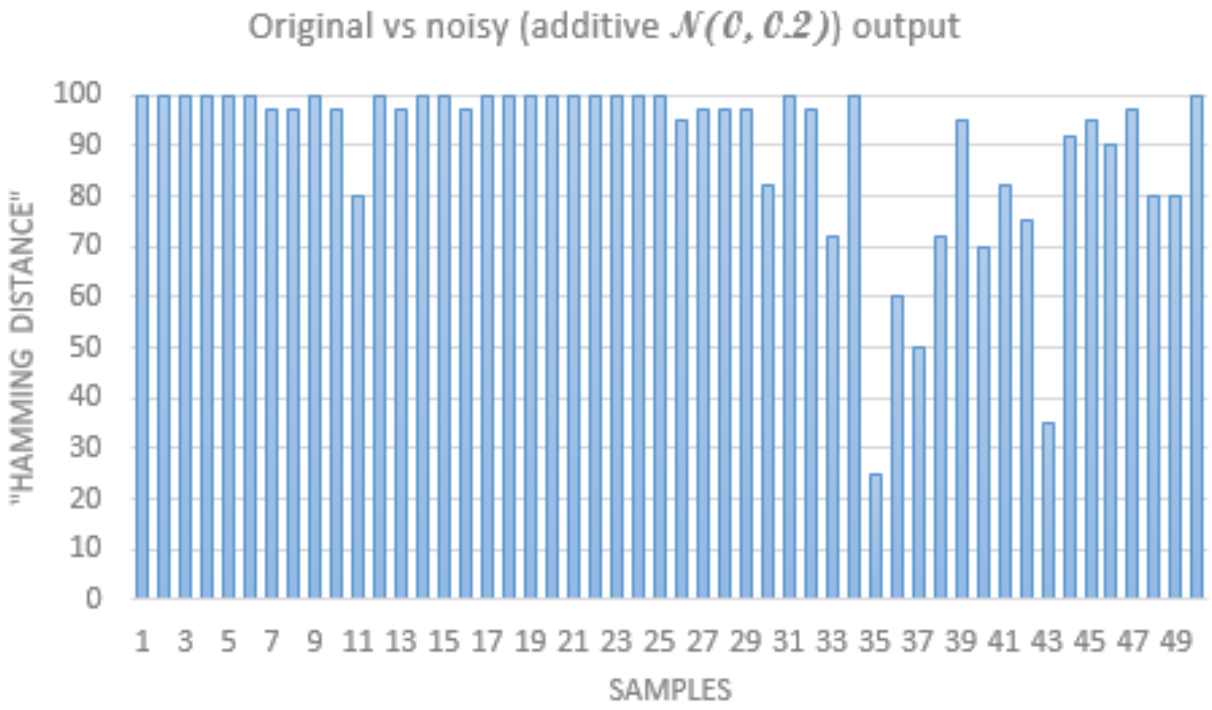

Figure 3. "Hamming distance" between original and noisy (N(0, 0.2)) Spatial Pooler output data sets with respect to the first 50 samples

Result and Discussion

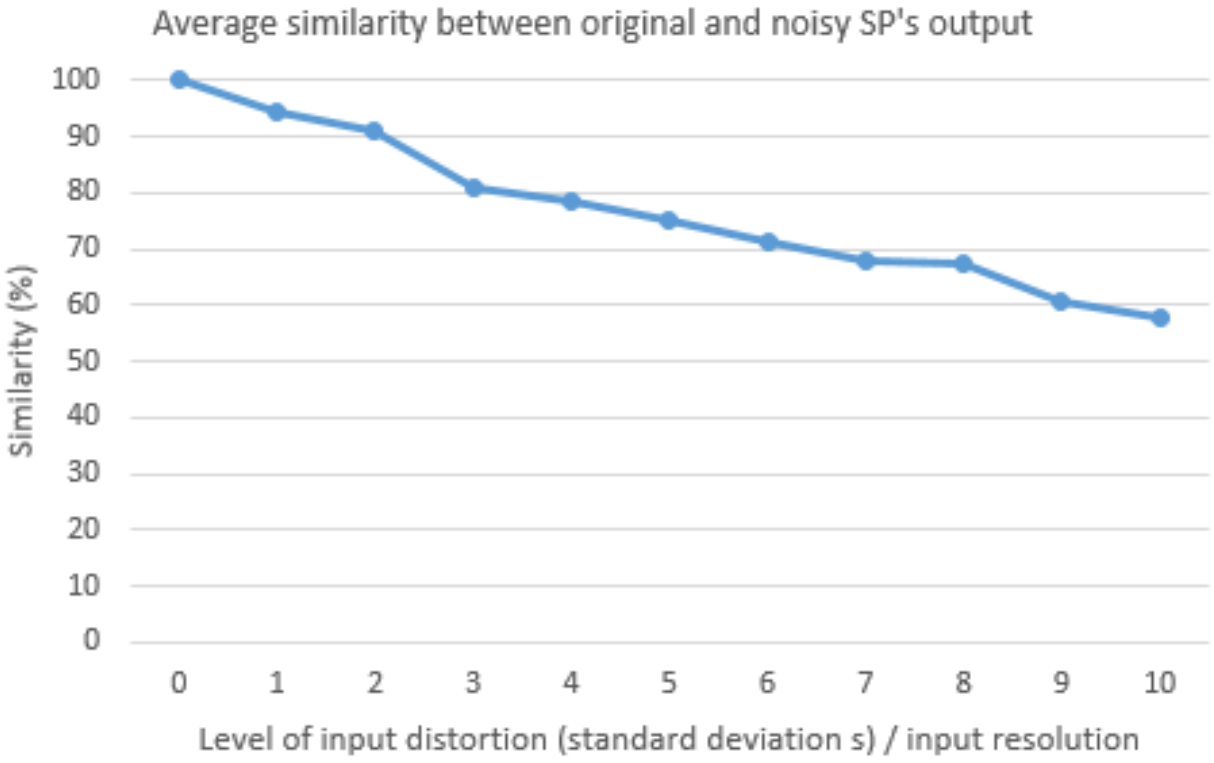

Figure 4. "Hamming distance" between original and noisy (N(0, 0.2)) Spatial Pooler output data sets with respect to the first 50 samples

Result and Discussion

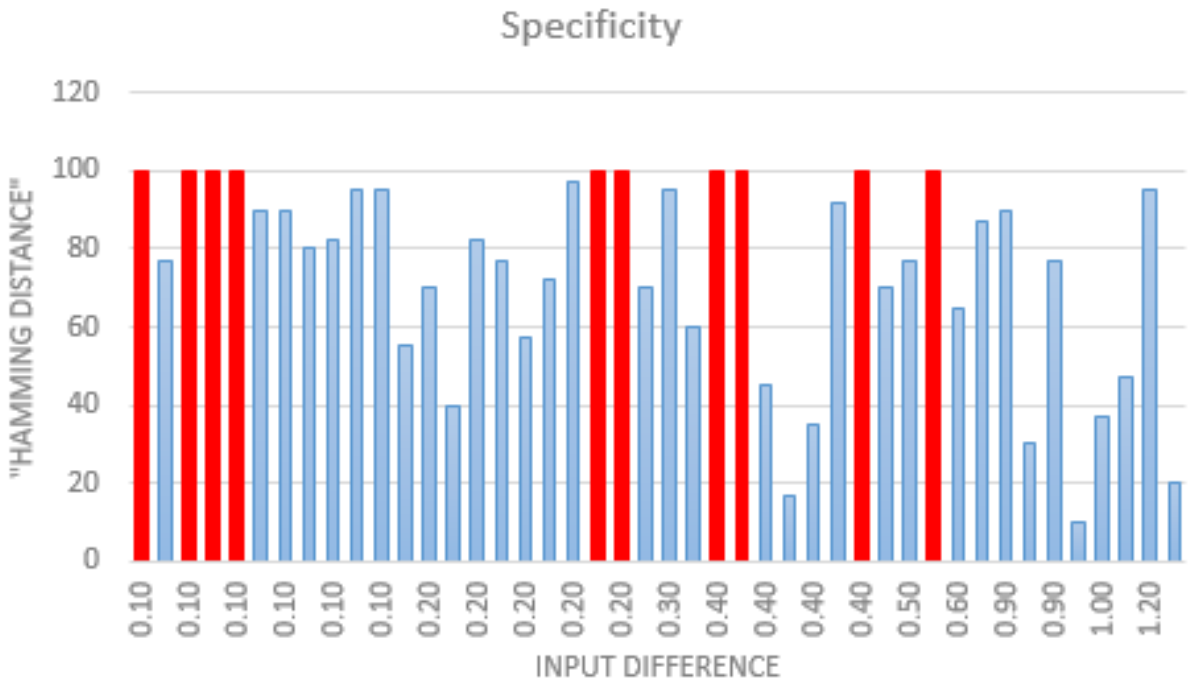

Figure 5. "Hamming distance" between outputs of trained Spatial Pooler with respect to two consecutively incremental input values regarding amplitude

Result and Discussion

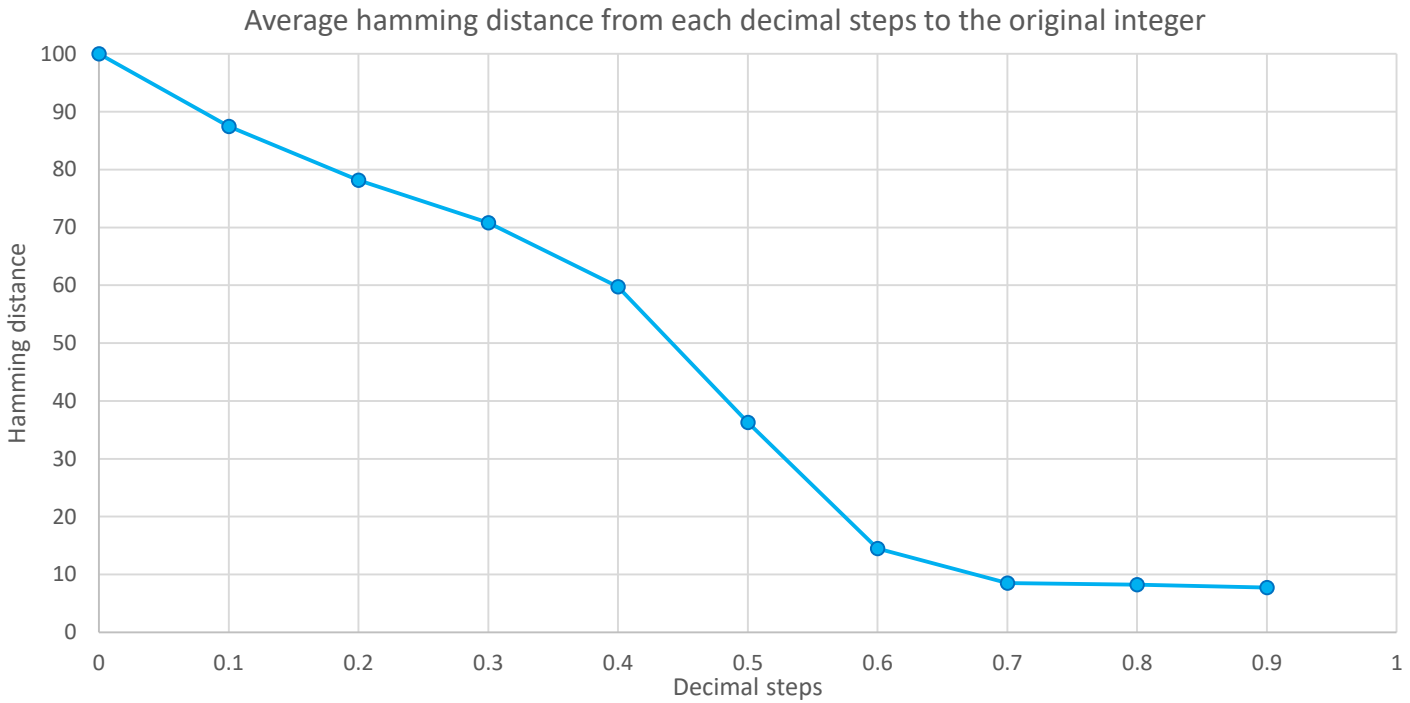

Figure 6. Average "Hamming distance" between each 0.1 decimal step and the integer number

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Conclusion

- **Noise robustness:** robust against relatively low levels of noise

- **Specificity:** Acceptable ability to differentiate two consecutively incremental input values

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