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# Towards Robust Deep-Learning Cryptographic Localization in Side-Channel Traces



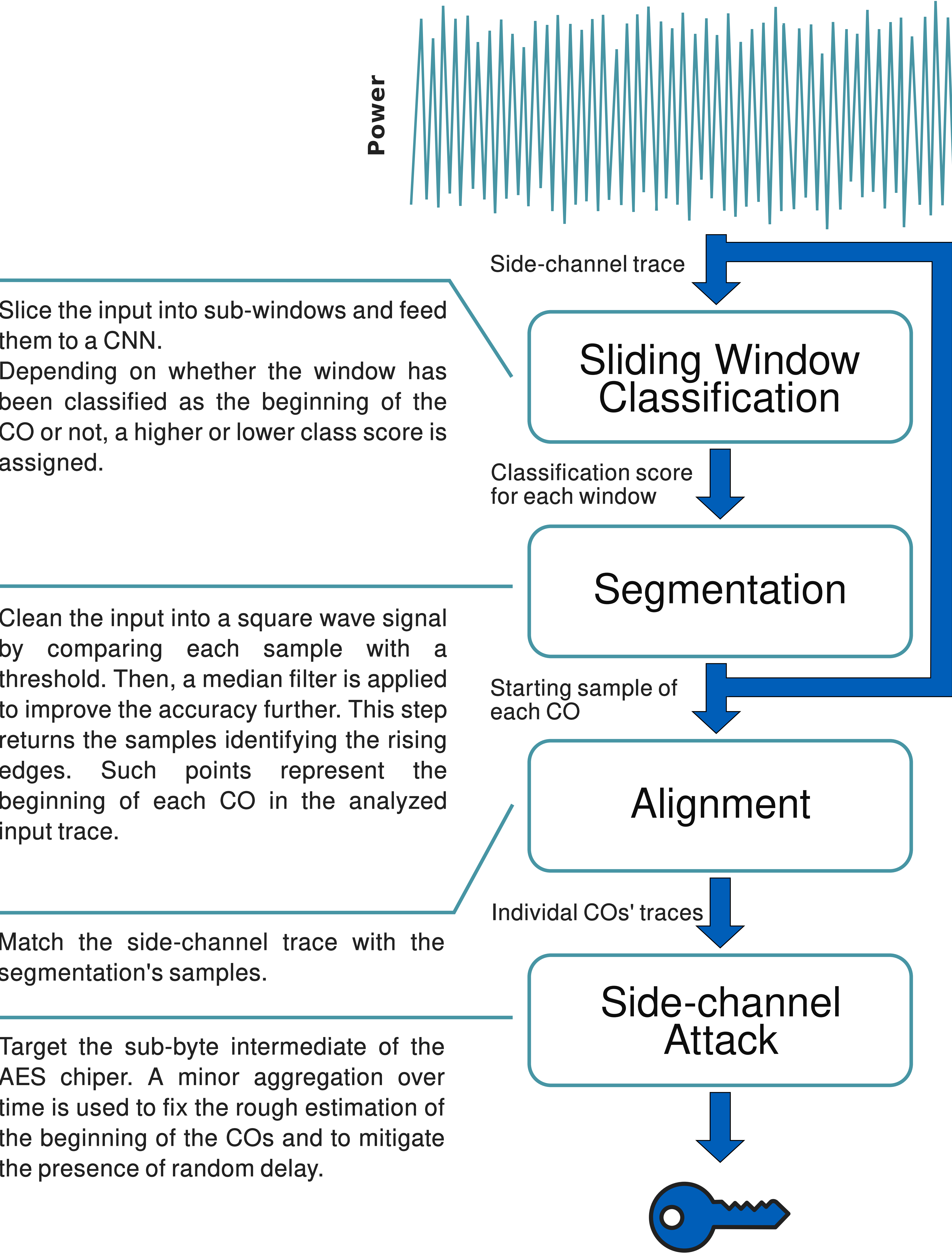
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A **successful side-channel attack** needs the attacker to:

- **Locate** in a side-channel trace the cryptographic operations (COs)
- **Align** in time the measured data

This work presents a **deep-learning technique** to accurately **locate cryptographic operations** in a side-channel trace, even in trace deformations. We validated our proposal through a successful attack against a variety of unprotected and protected cryptographic primitives that have been executed on an FPGA-implemented RISC-V CPU.



## Experimental Evaluation

- 5 COs: Clefia, Simon, Camellia, AES, AES mask
- Up to 2 (or 4) consecutive random delay instructions
- Interleave with noisy applications (or consecutive COs)

We are able to find **100%** of the COs for every tested configuration. CPA is successful with less than 4000 COs.

True label		0	
0	88.08%	11.92%	
1	0.03%	99.97%	
Predicted label		0	
1			
Clefia			

True label		0	
0	94.30%	5.70%	
1	7.90%	92.10%	
Predicted label		0	
1			
Simon			

True label		0	
0	99.92%	0.08%	
1	0%	100%	
Predicted label		0	
1			
Camellia			

True label		0	
0	99.87%	0.13%	
1	0.07%	99.93%	
Predicted label		0	
1			
AES mask			

True label		0	
0	99.56%	0.44%	
1	2.70%	97.30%	
Predicted label		0	
1			
AES			

## References

[1] G. Chiari, D. Galli, F. Lattari, M. Matteucci and D. Zoni, "A Deep- Learning Technique to Locate Cryptographic Operations in Side-Channel Traces," 2024 Design, Automation & Test in Europe Conference & Exhibition (DATE), Valencia, Spain, 2024, pp. 1-6.  
 [2] D. Galli, A. Galimberti, W. Fornaciari, and D. Zoni, "On the effectiveness of true random number generators implemented on fpgas," in International Conference on Embedded Computer Systems. Springer, 2022, pp. 315–326.

