A note on the comparison of distinguishers

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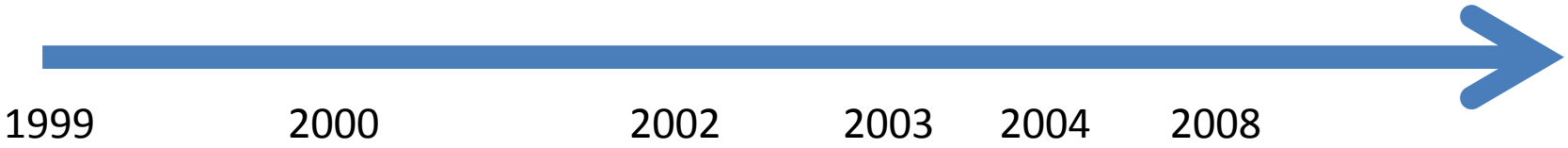
COSIC/KU Leuven

COSADE 2014, Paris

A jungle of distinguishers



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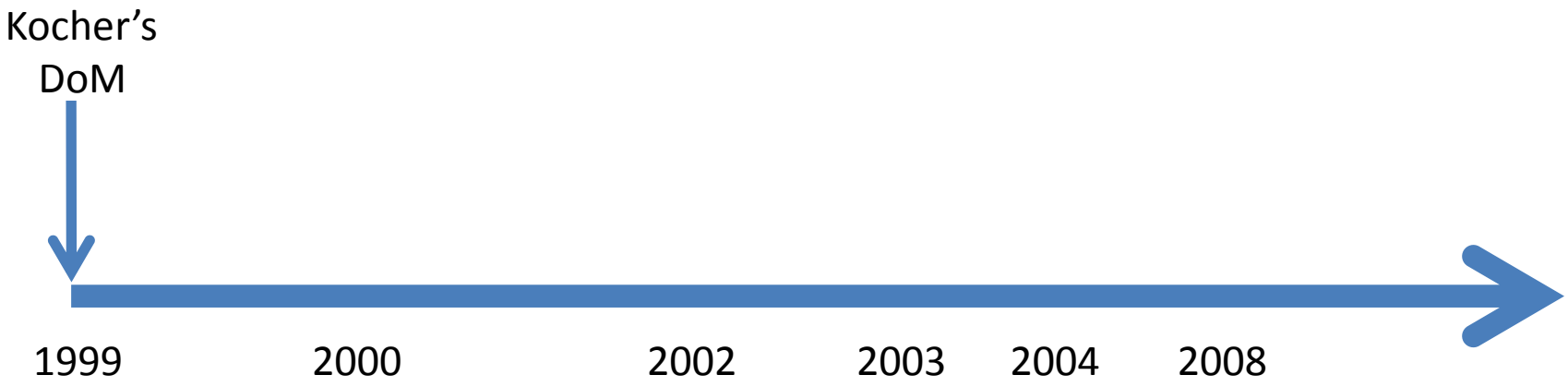

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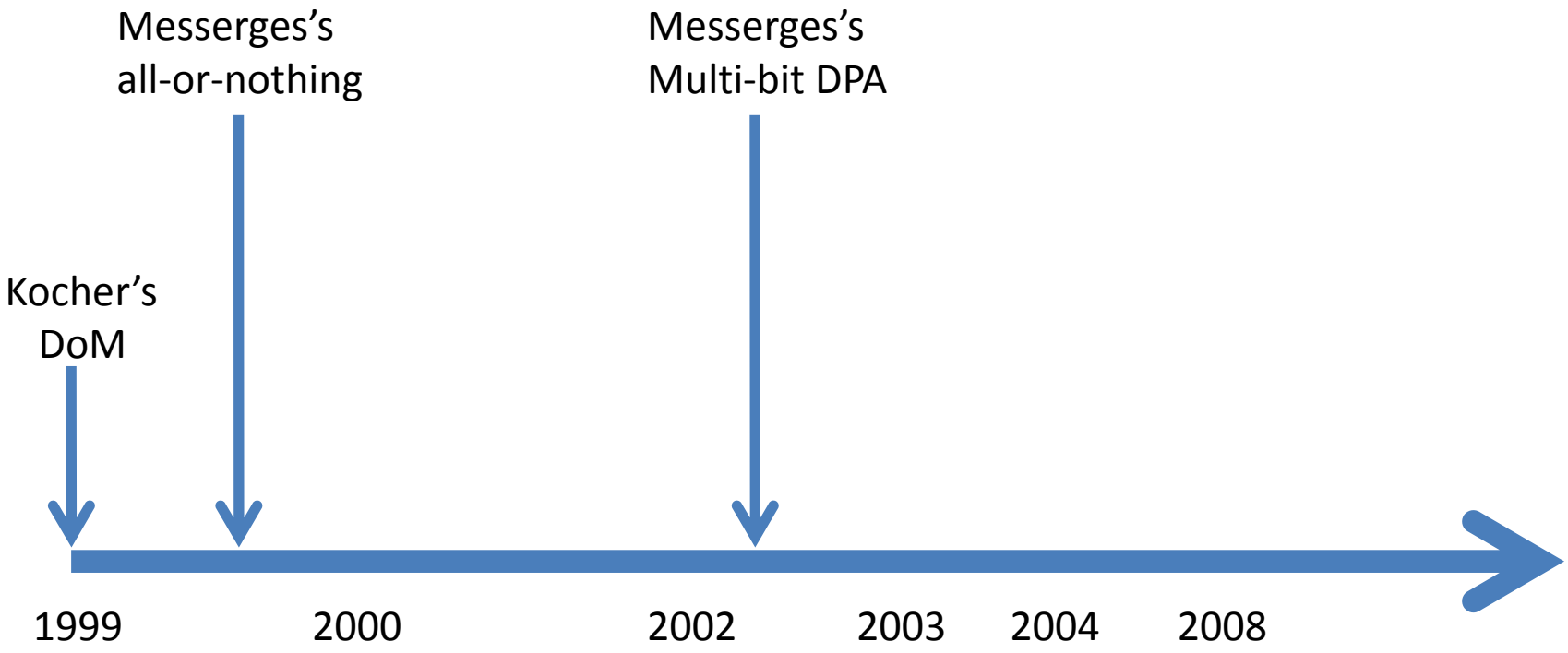

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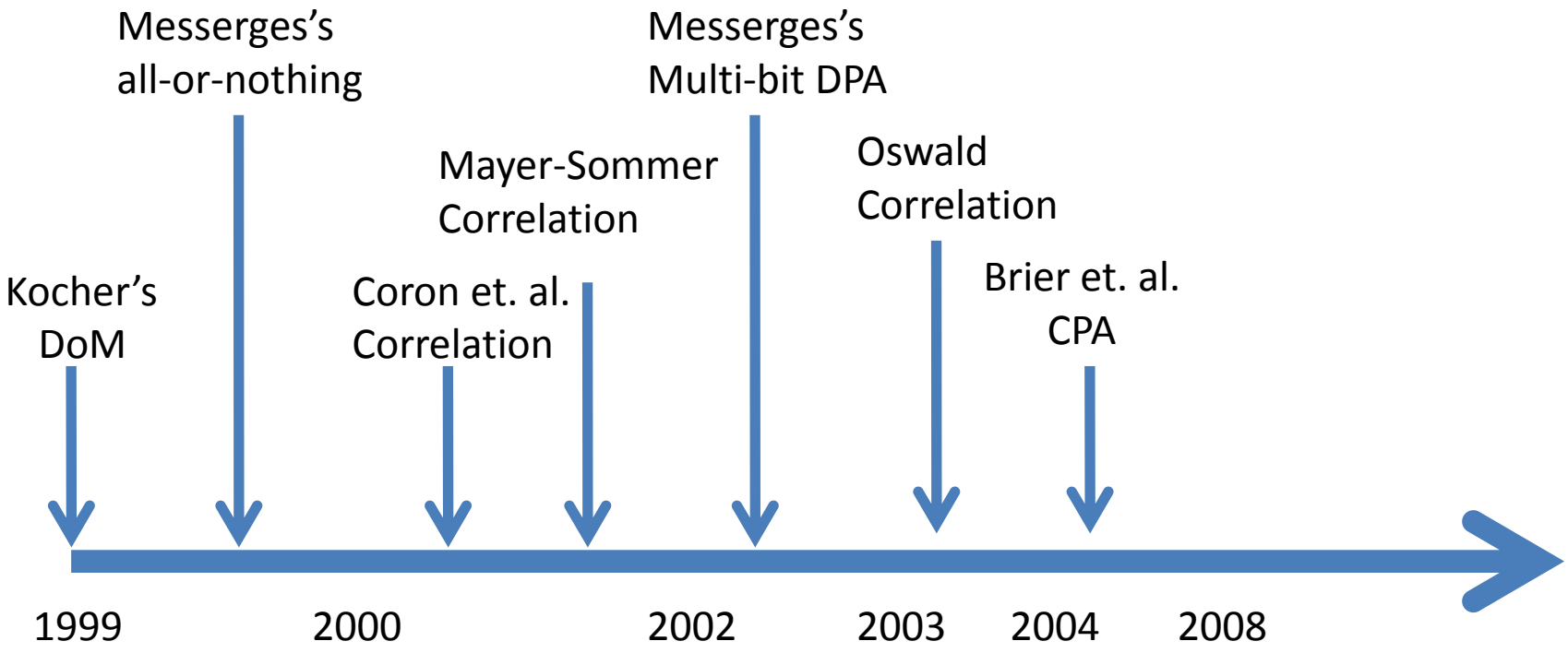

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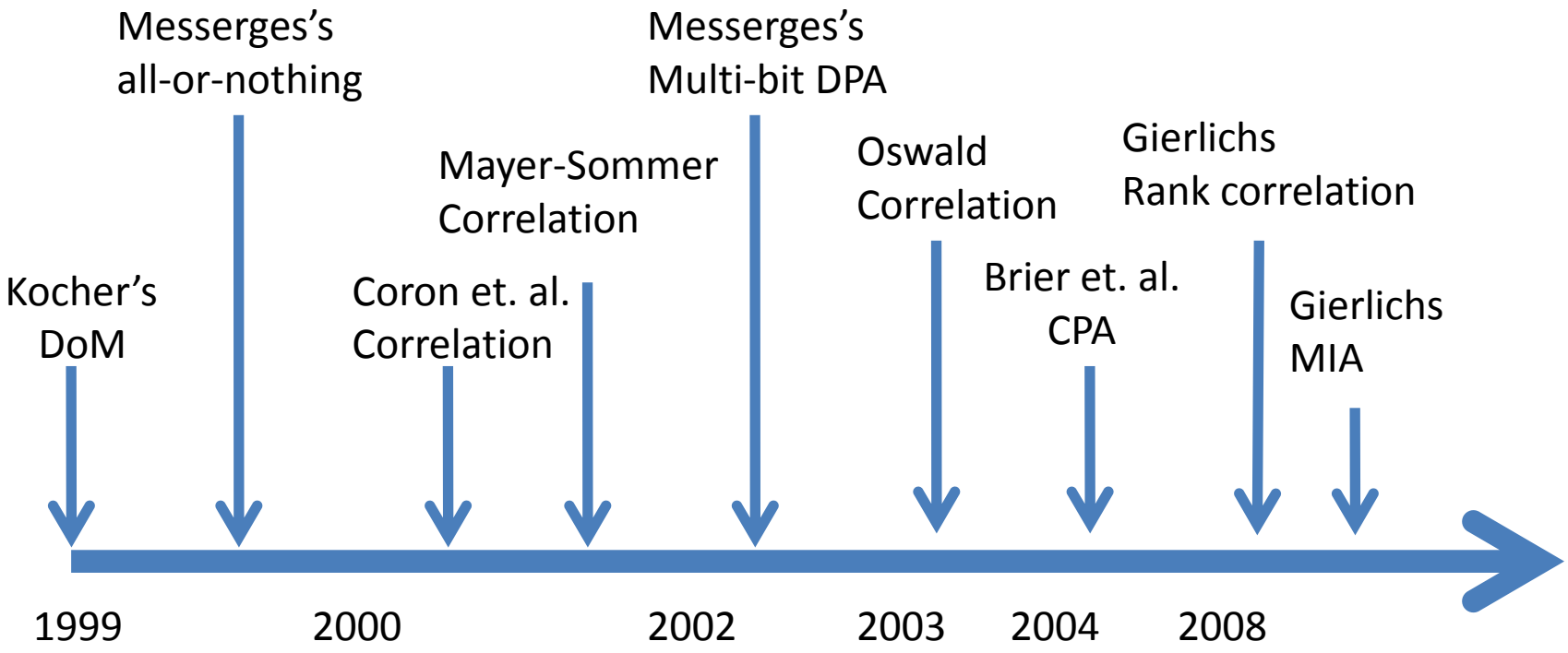

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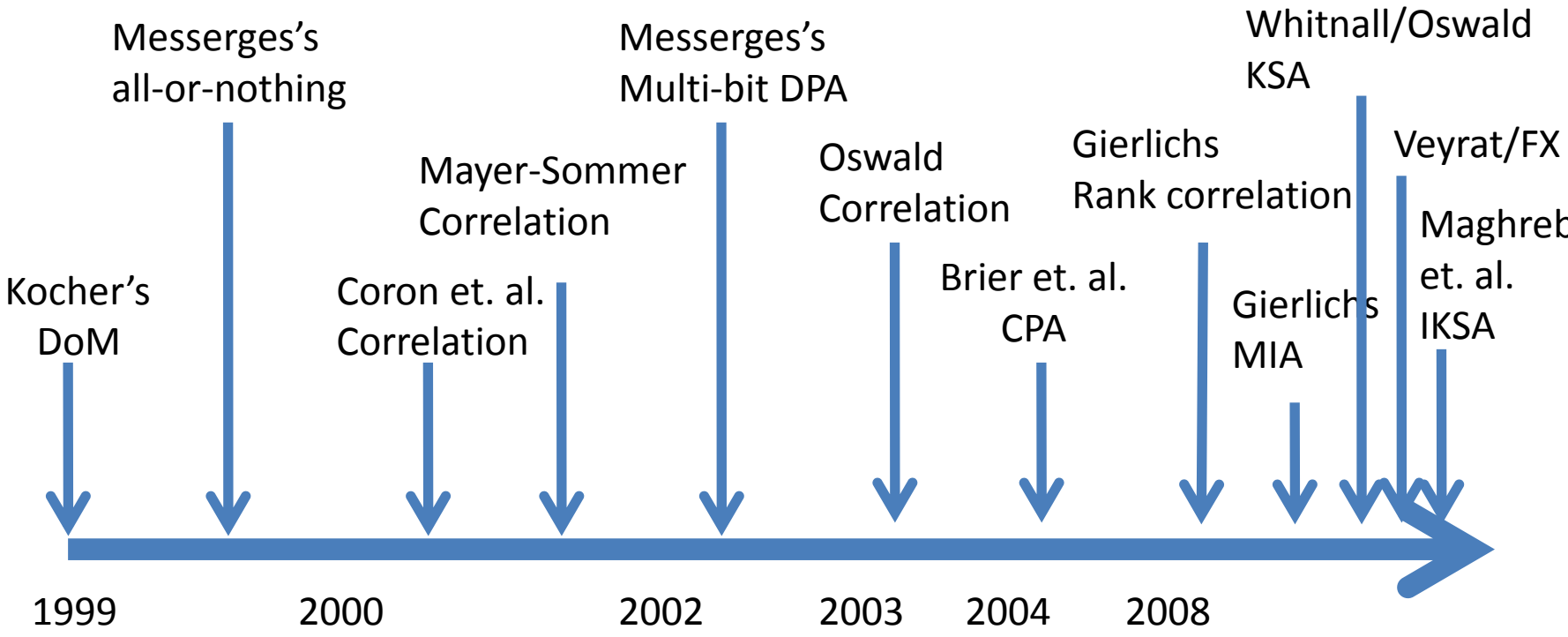


One for All - All for One: Unifying Standard DPA Attacks

Stefan Mangard[1], Elisabeth Oswald[2], François-Xavier Standaert[3⋆]

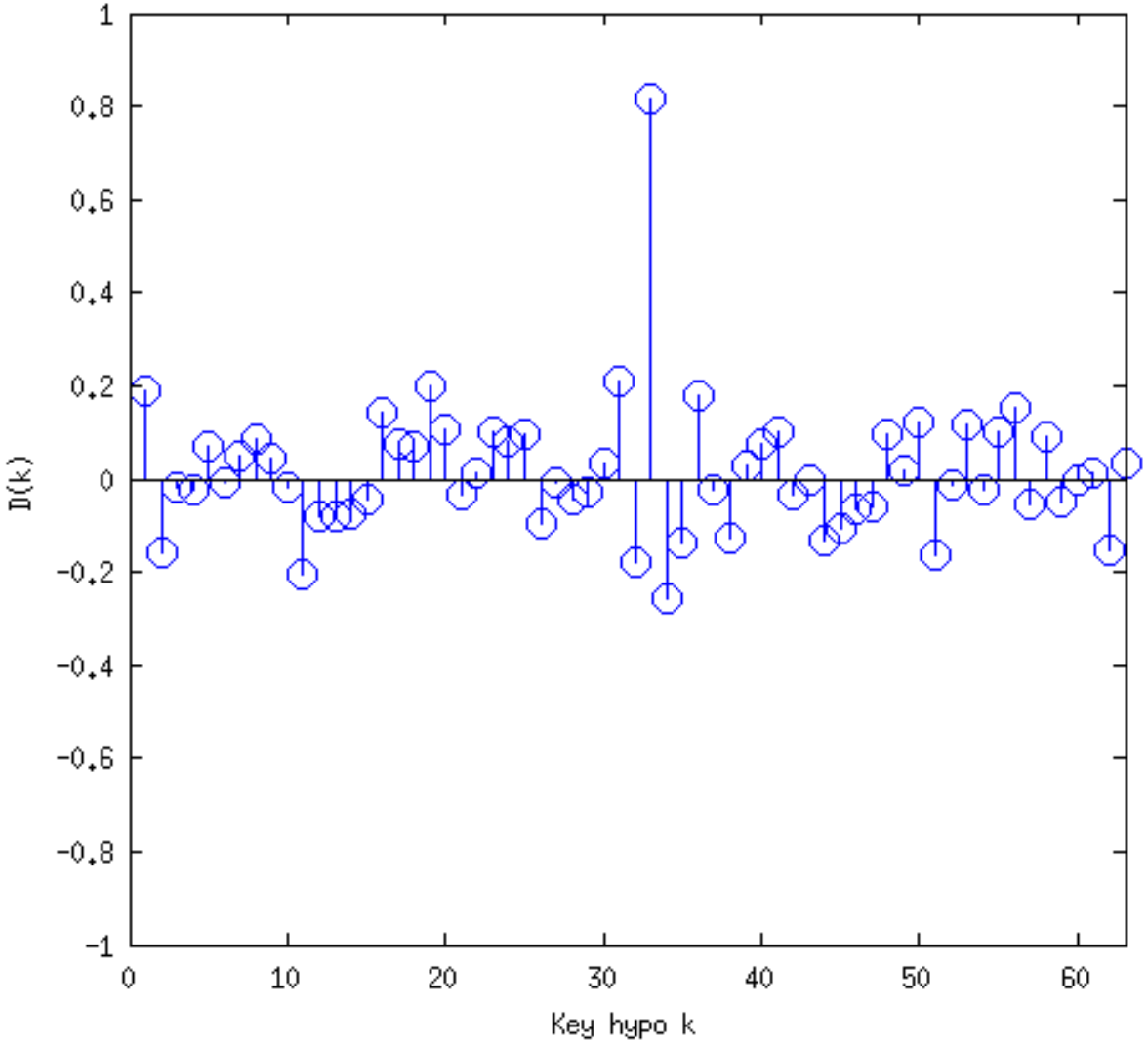
- Success rates

A fair evaluation framework for comparing side-channel distinguishers

Carolyn Whitnall · Elisabeth Oswald

- Introduces (theoretical) distinguishing margins

Definitions: distinguishing vector



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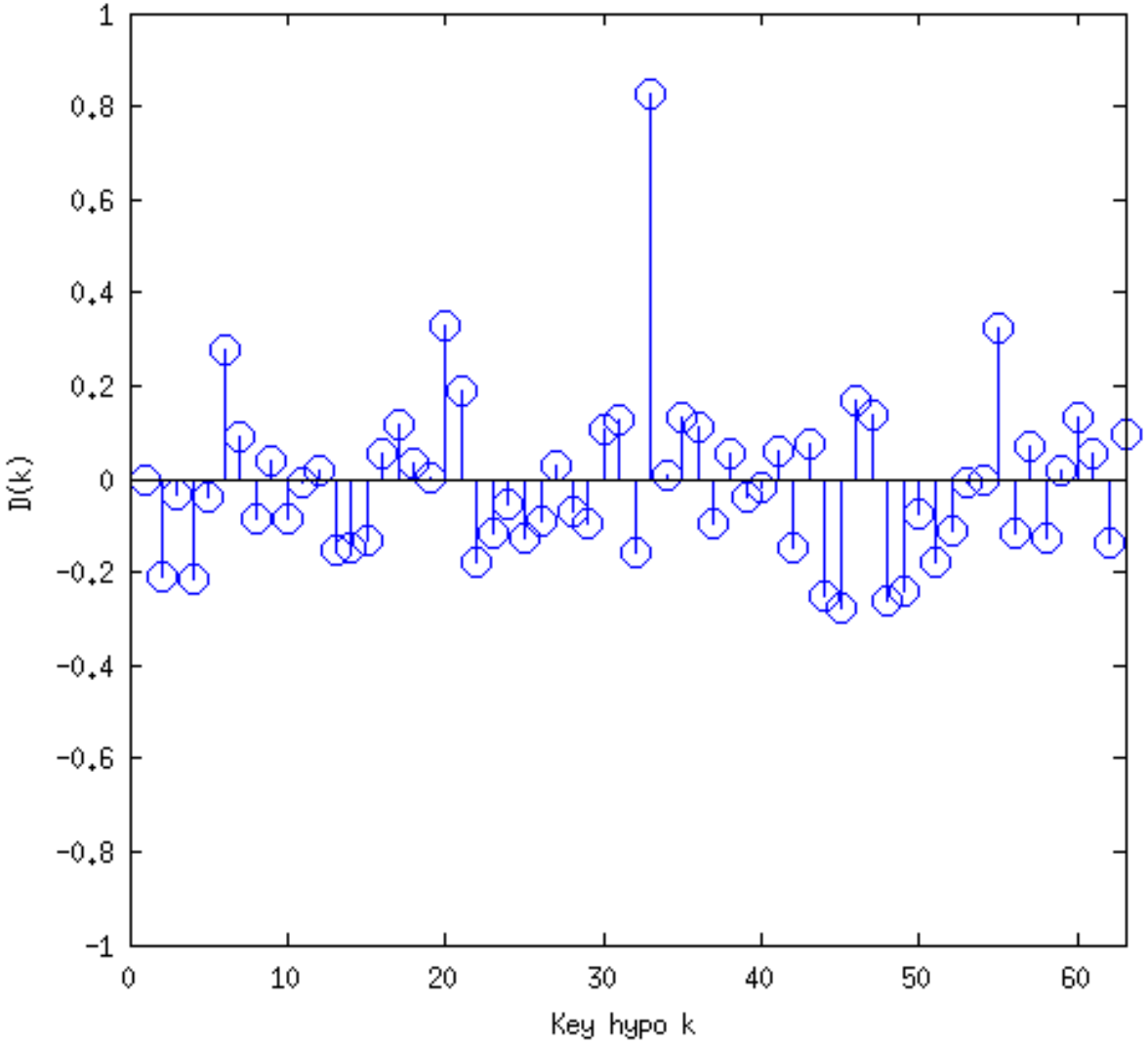

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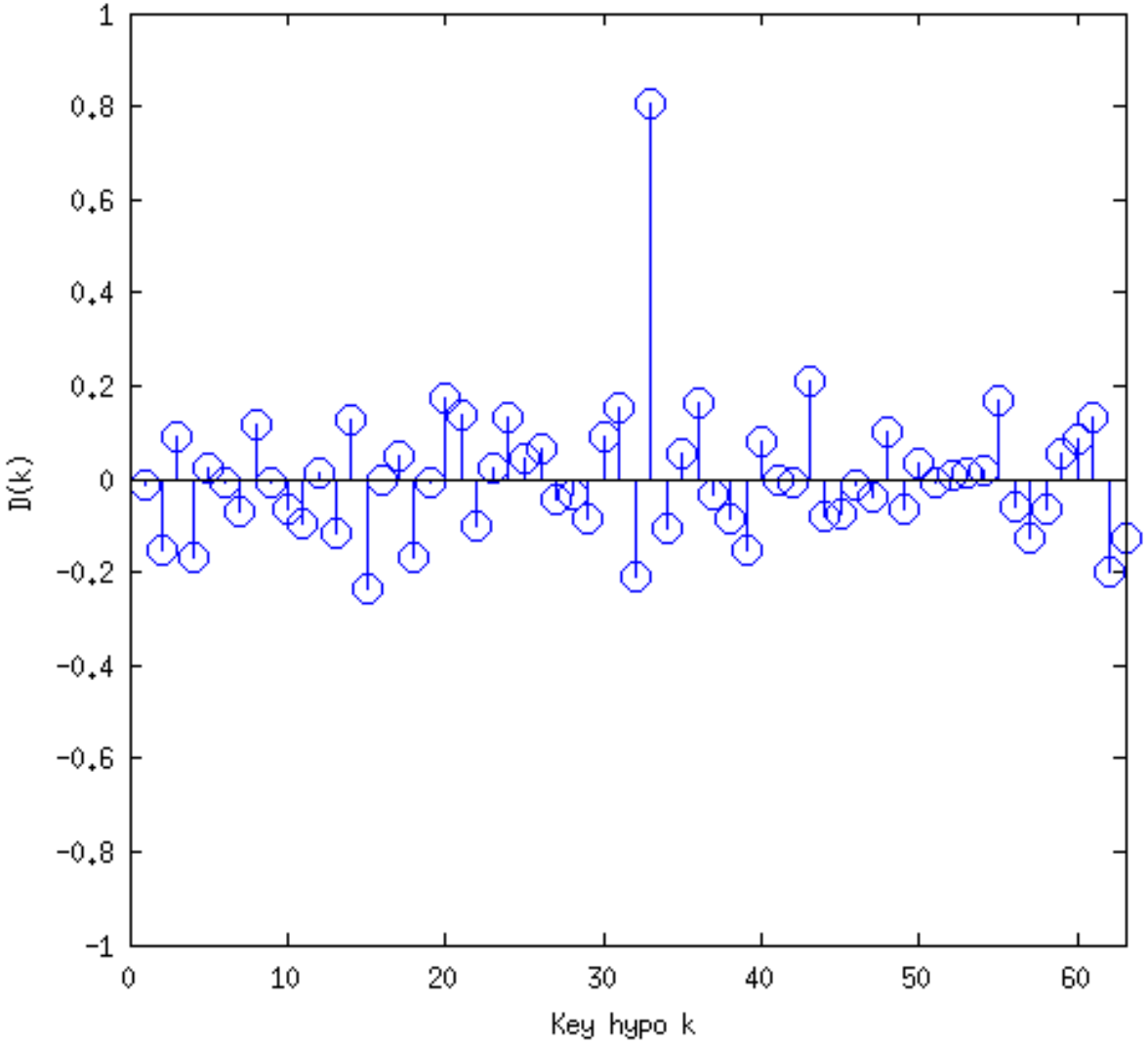

Definitions: success rate, relative margins

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  - Repeat the experiment, count how many successful

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- Success rates
  - Repeat the experiment, count how many successful
- Distinguishing margins
  - Normalized “distance” between correct key hypo and nearest rival

$$\mathrm{RelMargin}(D) = \frac{D(k^*) - \max\left[D(k)|k \neq k^*\right]}{\mathrm{std}(D)}$$

Comparision success rates vs. distinguishing margins

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- + Can be (easily) computed in a theoretic way for many distinguishers (thereby circumventing estimation issues)
- - should not be taken as the sole metric

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- Absolute value of DoM

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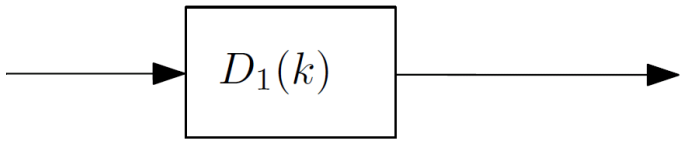
$$D_1(k) = \left| \widehat{\mathbf{E}}(T|L(Z_k) = 1) - \widehat{\mathbf{E}}(T|L(Z_k) = 0) \right|$$



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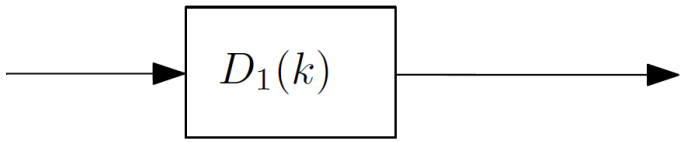

Distinguisher 2

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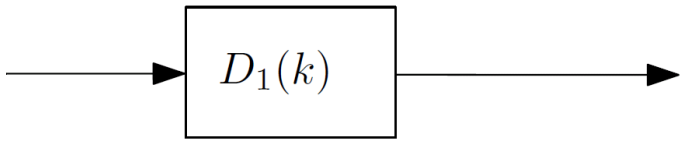
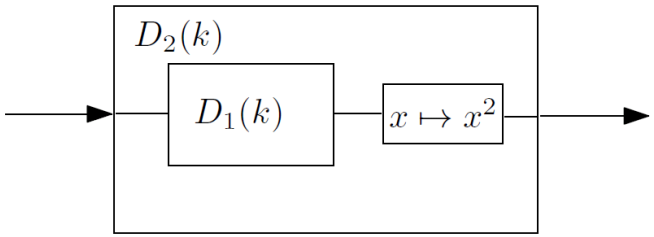


Distinguisher 2

- Absolute value of DoM, squared

$$D_2(k) = [D_1(k)]^2 = \left| \widehat{\mathbf{E}}(T|L(Z_k) = 1) - \widehat{\mathbf{E}}(T|L(Z_k) = 0) \right|^2$$



Distinguishing vectors for distinguisher 1 and 2

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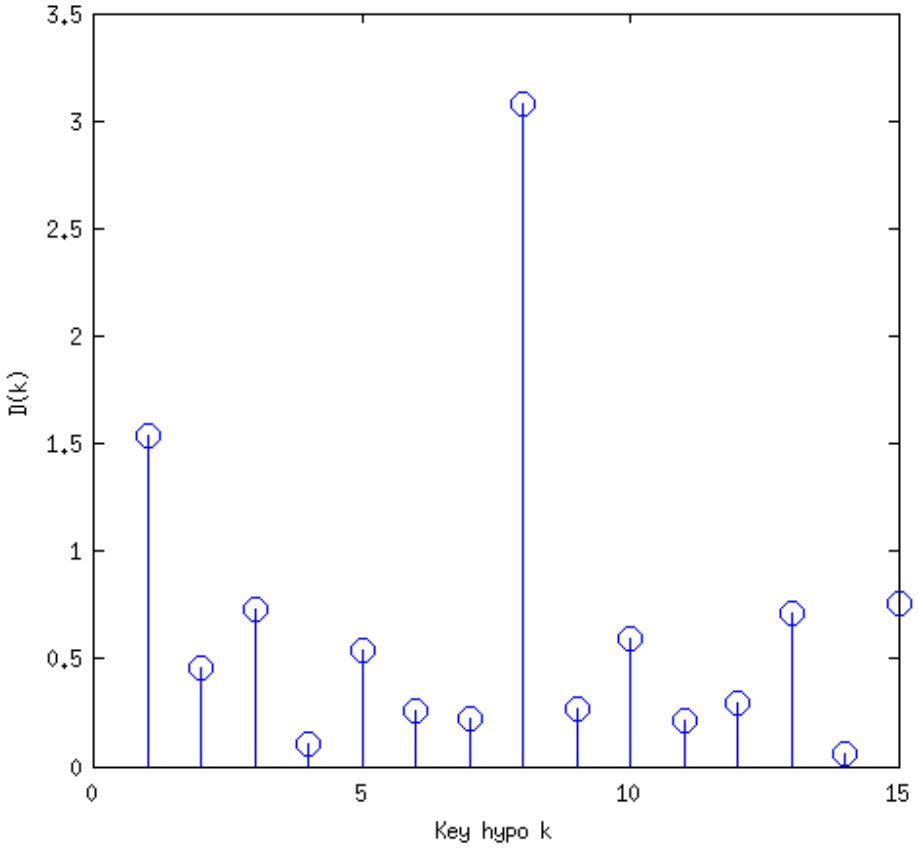

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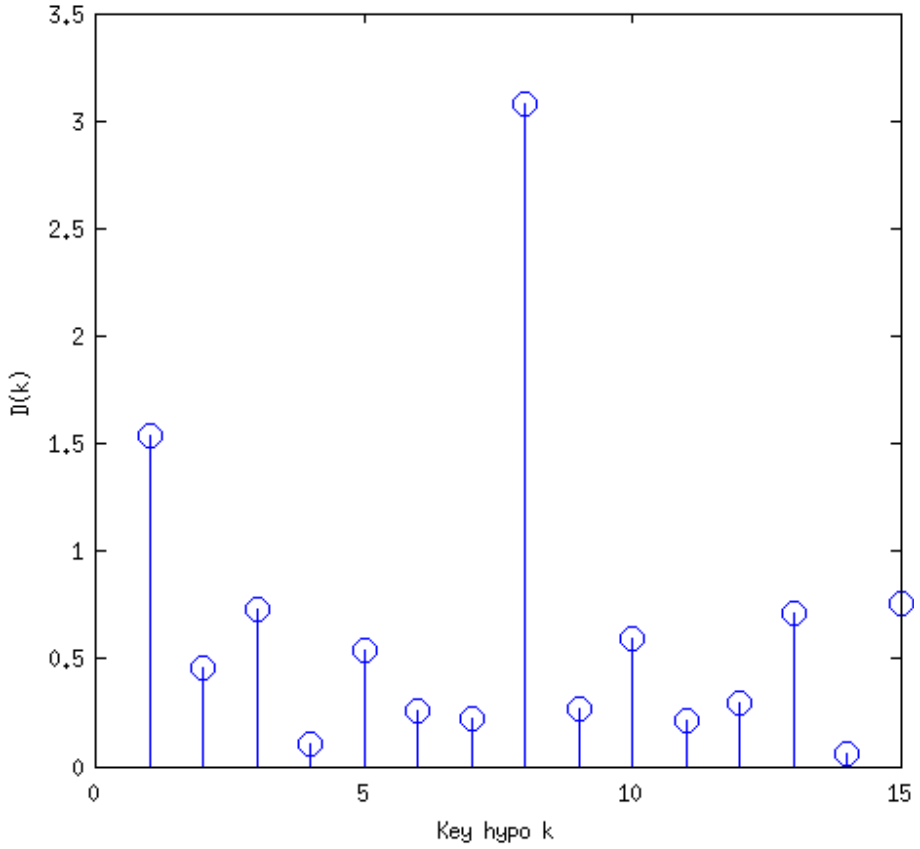

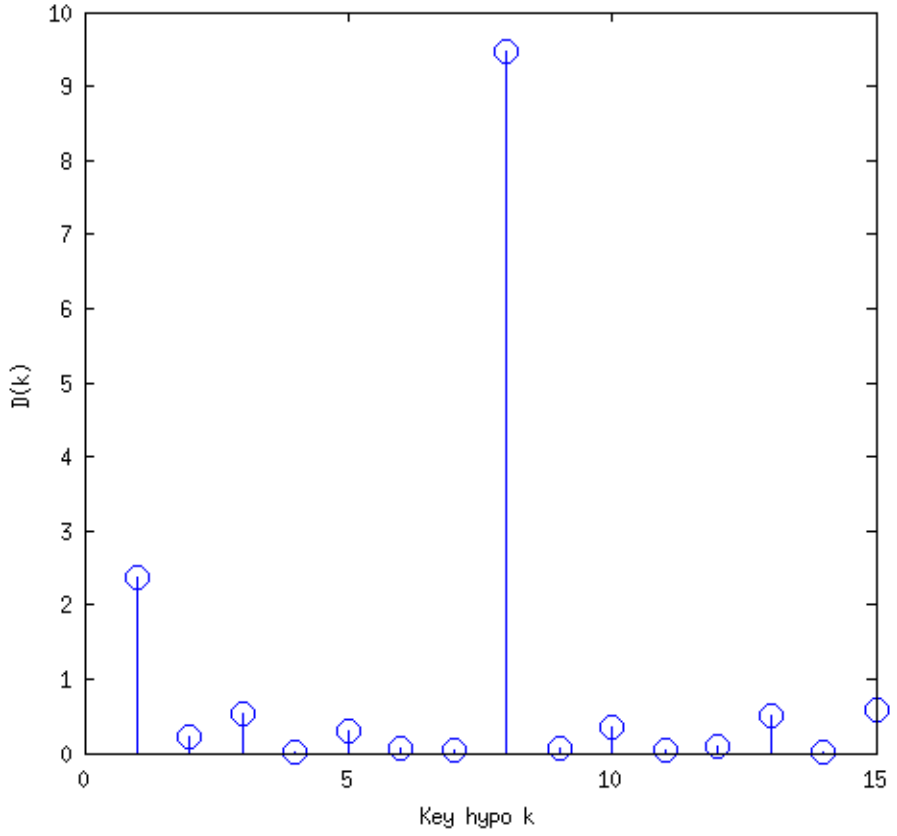

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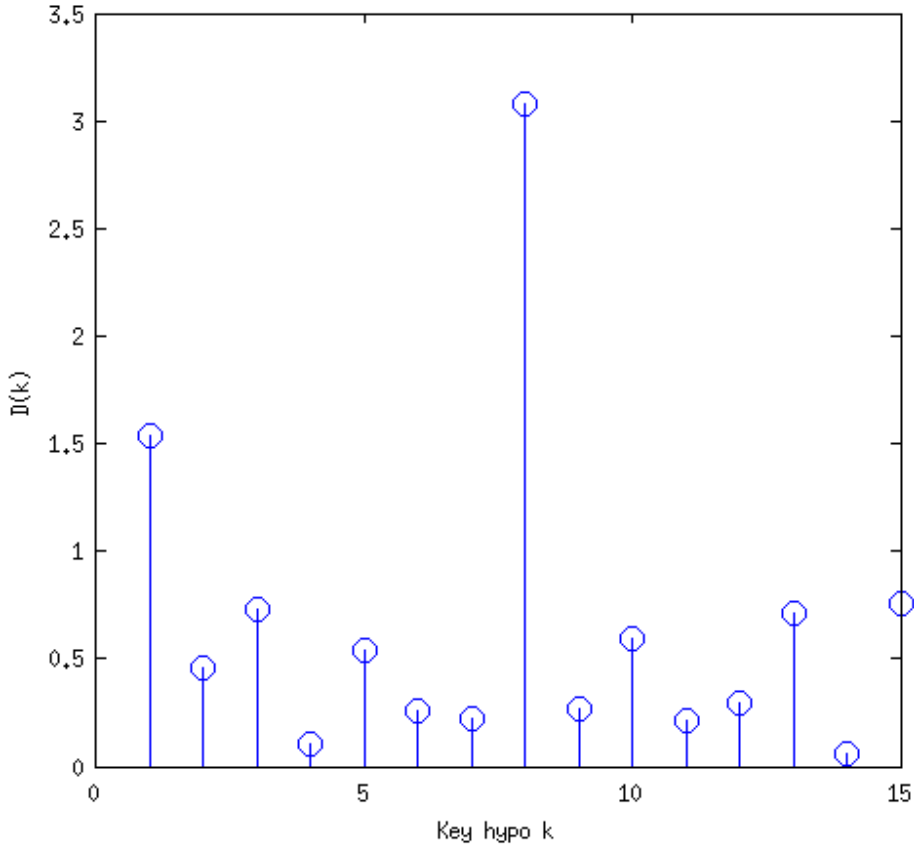

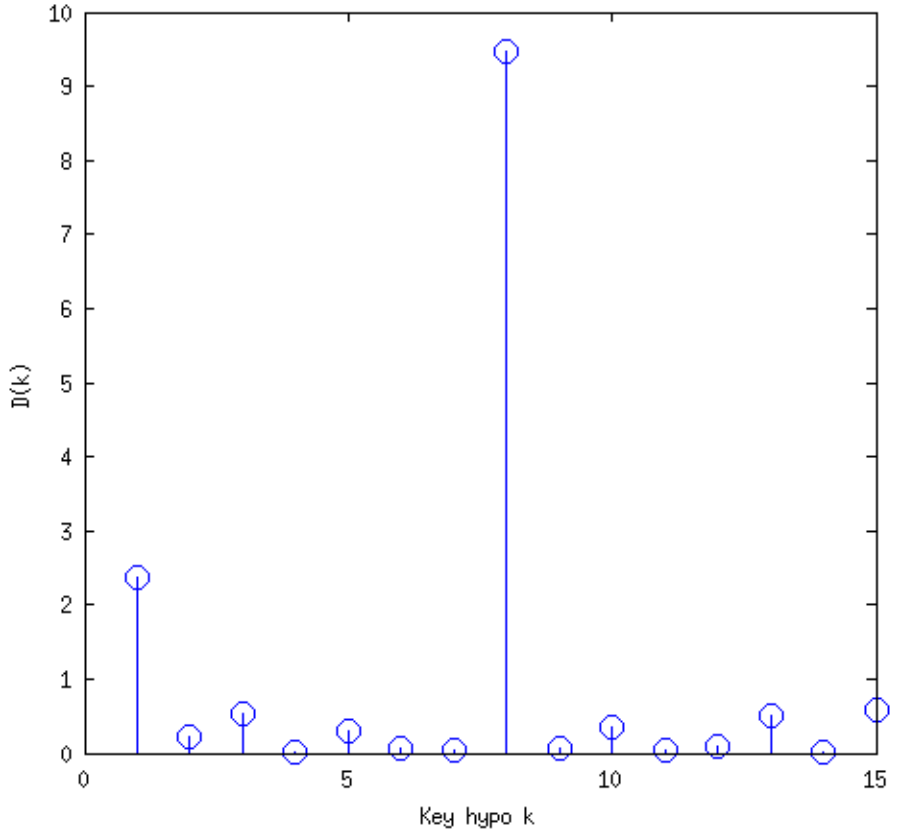

Order preserved → same success rate

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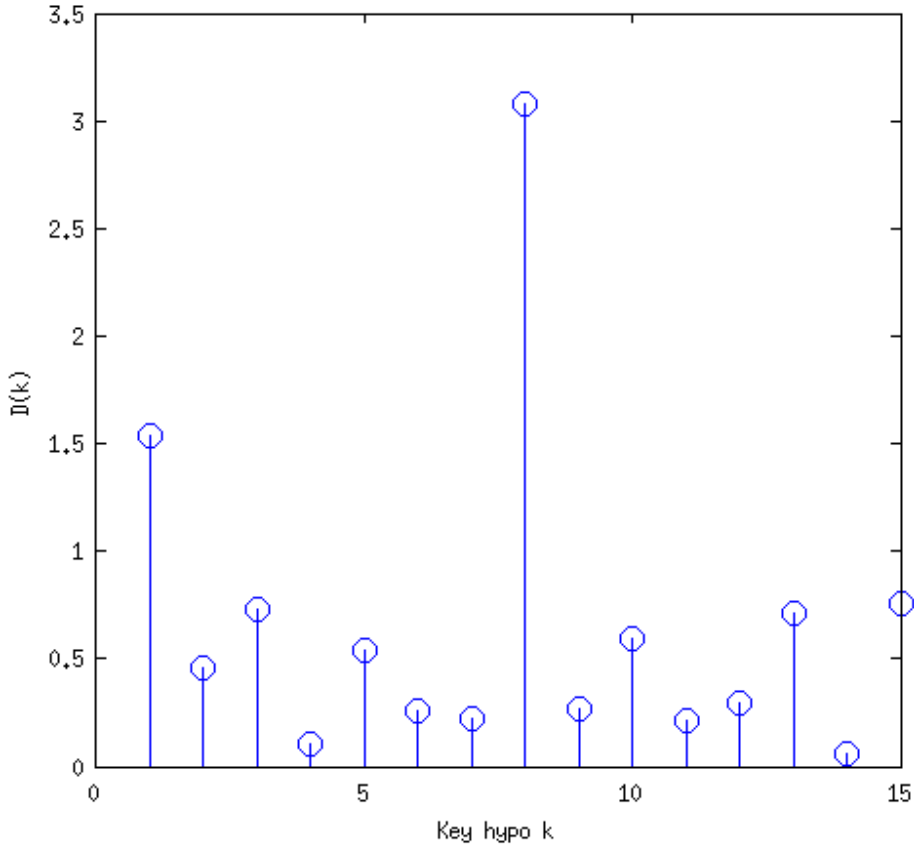

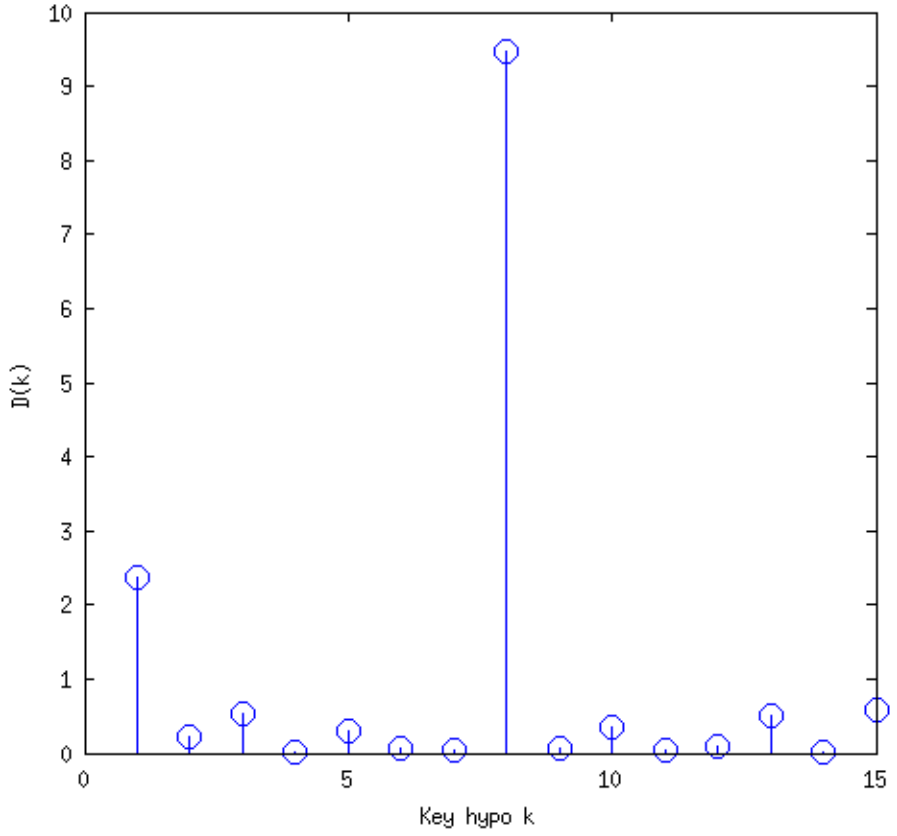

RelMargin(D1) = 0.25 ≠ RelMargin(D2) = 0.51

A different D1 box

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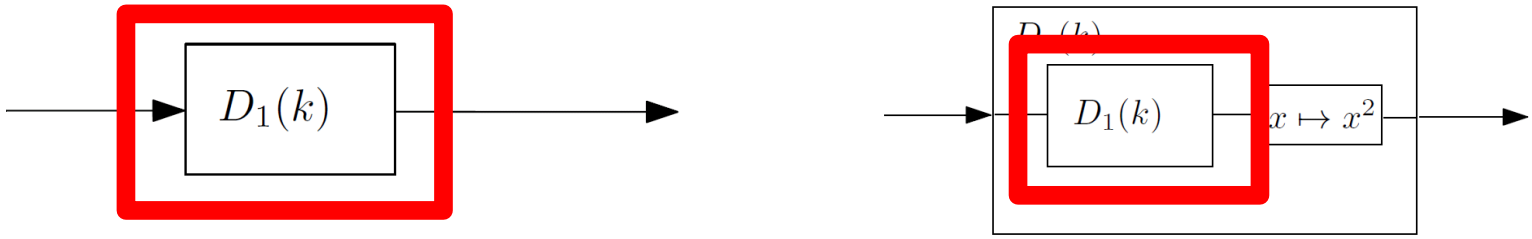

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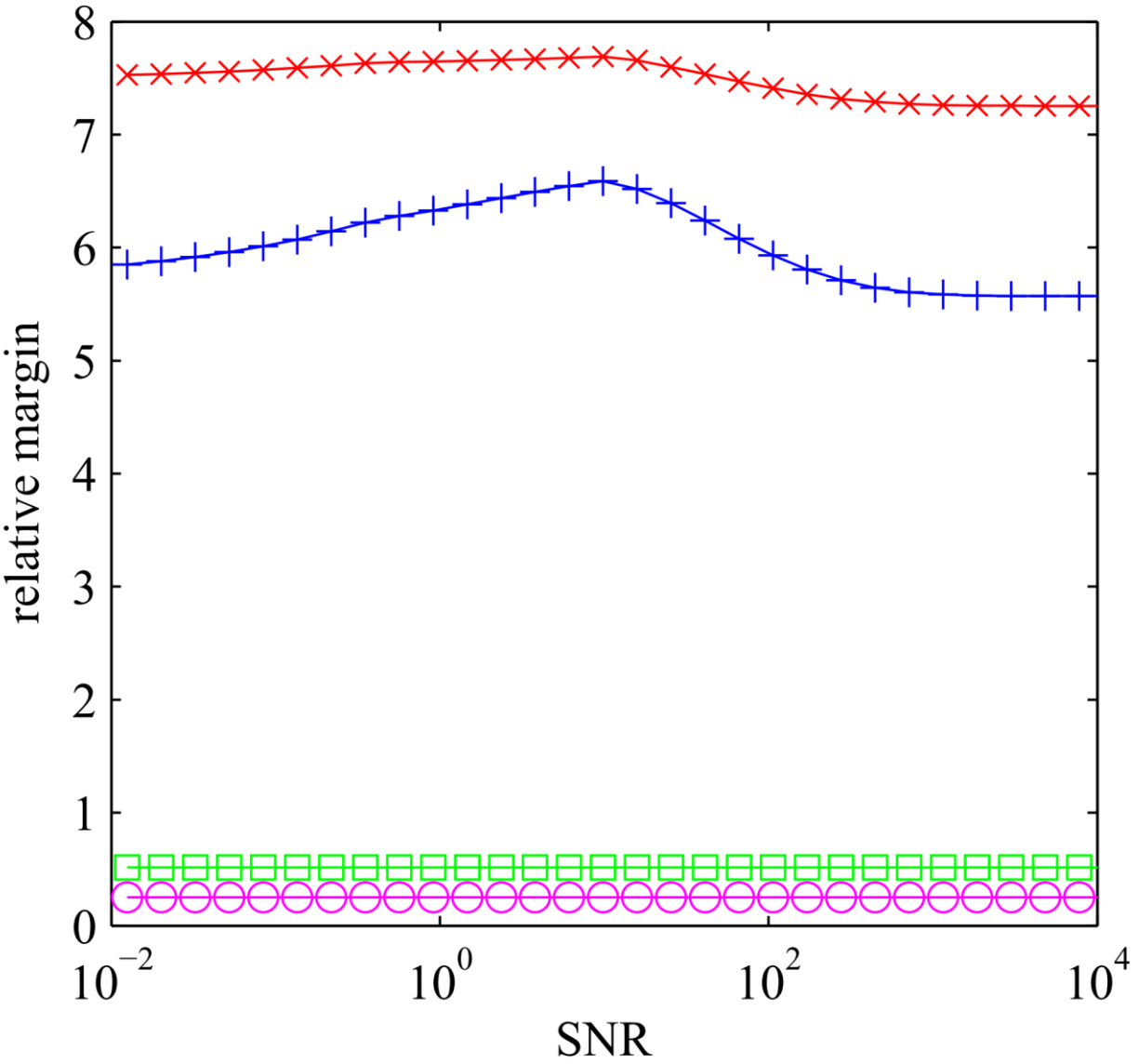
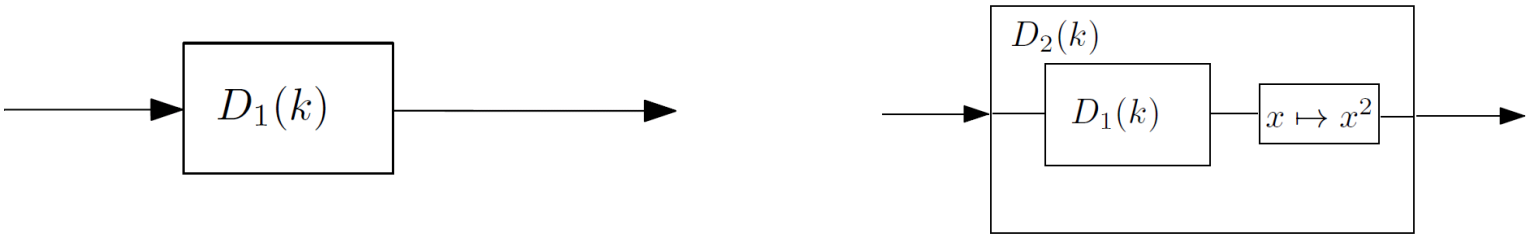


Different transformation functions



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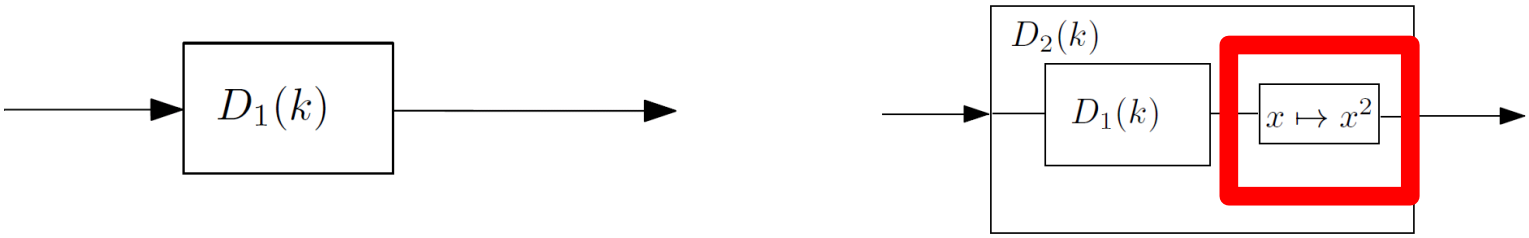

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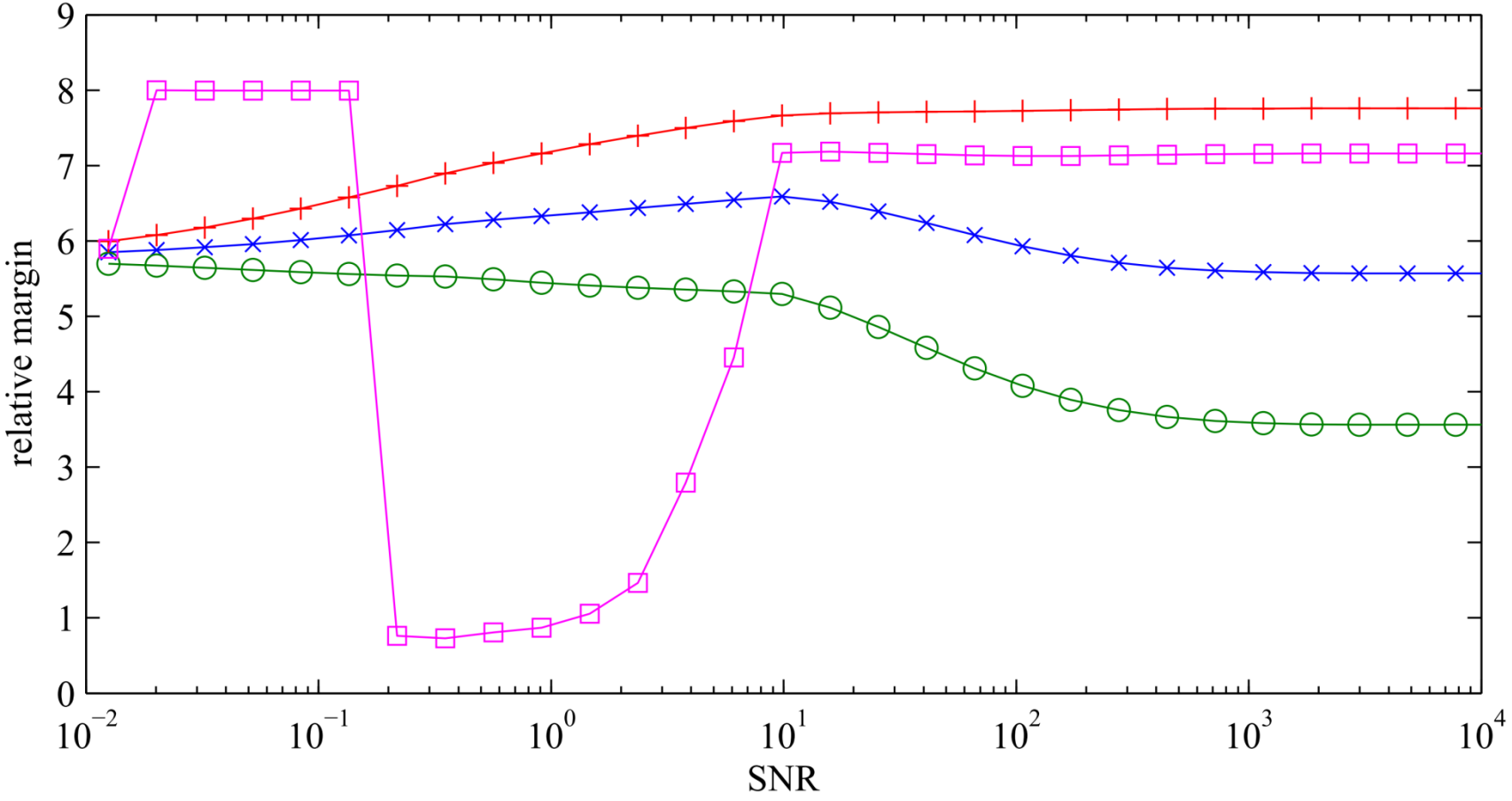

Conclusion

- No one-fits-all solution
- Nice theoretical properties, but sometimes *too* theoretical