Fisher Information: Two Approaches

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Fisher Information

Capacity is **the** most important question in empirical steganography.

Capacity of imperfect stego systems follows a square root law:

$$\text{capacity} \sim r\sqrt{\text{coversize}}$$

and the root rate r is determined by **Fisher Information**:

$$r \sim 1/\sqrt{I}.$$

We have presented two approaches to estimating Fisher Information

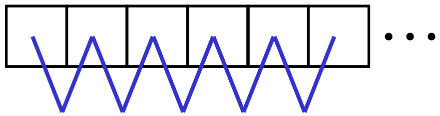
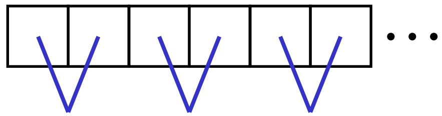
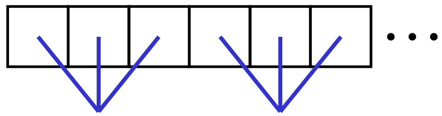
- for artificial covers (in Böhme's sense),
- the models have many parameters, estimated from real image corpus.

Applications:

- **Fundamental** benchmarking of embedding functions,
- Comparison of cover sources,
- Optimization of embedding functions,

Note that all conclusions are specific to the cover corpus tested.

Two approaches

	Filler & Fridrich	Ker
Model	Markov chain • *captures true second order* • *mathematically sophisticated*	Independent pixel groups • *cannot be true* • *not very sophisticated* • *captures high-order dependencies*
	 Captures all 2nd-order dependencies	 Captures only intra-block dependencies  ...but can be extended to 3rd-order and higher

Two approaches

	Filler & Fridrich	**Ker**
Model	Markov chain • *captures true second order* • *mathematically sophisticated*	Independent pixel groups • *cannot be true* • *not very sophisticated* • *captures high-order dependencies*
Estimator	fit quasi-GGD to empirical pixel difference	plug in empirical histogram
Properties	consistent	consistent (but danger of overfitting)
Complexity	low	can be very high
LSB vs ±1	±1 > LSB replacement (root rate about 1.5× greater)	±1 > LSB replacement (root rate about 1.5× greater) (less for higher-order evidence)