HELP TO SOME OF THE QUESTIONS

1 Noise Removal / Image Pre-Compression

(c) What does pre-compression mean?

What is the idea behind data de-noising?

So data de-noising is a rigorous way to pre-compress noisy data! Isn't it??

→ What do you conclude?

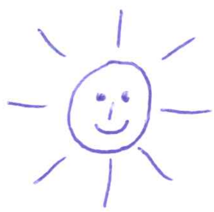
2 Miscellanea

(a) Perhaps, I have helped you too much :-)

See question **(c)**!

But I am sure you want to know more about

HYBRID IMAGES



- http://cvcl.mit.edu/publications/Talk-Hybrid_Siggraph06.pdf

  These are presentation slides!

- http://cvcl.mit.edu/publications/Hybrid.mp4

  This is a movie presentation!

- http://cvcl.mit.edu/publications/OlivaTorralb_Hybrid_Siggraph06.pdf

  This is the original paper by Oliva, Torralba & Schyns (2006)

- http://cvcl.mit.edu/hybridimage.htm

  This is their home page with other useful links

HAVE FUN!

(b) Not as simple as it seems.....

- Single-pixel entropy:

$$H_1 = - \sum_{i=0}^{1} p_i \log_2 p_i$$

- What about p_i ?

- The expected probabilities are equal:

$$P_0 = P_1 = \frac{1}{2}$$

- But the observed probabilities can be significantly different, for example $p_0 \ll p_1$!

- Let us quantify this point.....

- What is the probability of getting n_0 heads when you throw the coin N times ?

$$P_B(n_0, N) = \frac{N!}{n_0!\,(N-n_0)!} \left(\frac{1}{2}\right)^{n_0} \left(\frac{1}{2}\right)^{N-n_0}$$

variable

parameter

$$= \frac{N!}{n_0!\,(N-n_0)!} \left(\frac{1}{2}\right)^{N}$$

This is the binomial distribution!

- What is the mean of n_0?

$$\mu_0 = \frac{1}{2} N$$

- What is the standard deviation of n_0?

$$\sigma_0 = \frac{1}{2} \sqrt{N}$$

→ The observed n_0 can be estimated as

$$\underbrace{\mu_0}_{\text{expected value}} \pm \underbrace{\sigma_0}_{\text{uncertainty}} = \frac{1}{2} N \left(1 \pm \frac{1}{\sqrt{N}}\right)$$

- What about the observed p_0?

$$p_0 = \frac{n_0}{N} \approx \frac{\mu_0 \pm \sigma_0}{N} = \frac{1}{2}\left(1 \pm \frac{1}{\sqrt{N}}\right)$$

- And what about the observed p_1?

$$p_1 \approx \frac{1}{2}\left(1 \underbrace{\mp}_{\text{Why?}} \frac{1}{\sqrt{N}}\right)$$

$$\Rightarrow H_1 \approx -\frac{1}{2}\left(1 \pm \frac{1}{\sqrt{N}}\right) \log_2 \left[\frac{1}{2}\left(1 \pm \frac{1}{\sqrt{N}}\right)\right]$$

$$- \frac{1}{2}\left(1 \mp \frac{1}{\sqrt{N}}\right) \log_2 \left[\frac{1}{2}\left(1 \mp \frac{1}{\sqrt{N}}\right)\right]$$

$\approx$ ..... compute it by yourself,

if you don't believe me ☺ .....

$$\approx 1 - \frac{\log_2 e}{N}$$

- Summarizing:

$$\left|\frac{\Delta p_i}{p_i}\right| \approx \frac{1}{\sqrt{N}} \quad \underline{\text{versus}} \quad \left|\frac{\Delta H_1}{H_1}\right| \approx \frac{1}{N}$$

- What does this mean?

* $N \sim 100 \Rightarrow \begin{cases} \text{uncertainty in } p_i \sim 10\% \\ \text{uncertainty in } H_1 \sim 1\% \end{cases}$

* $N \sim 10 \Rightarrow \begin{cases} \text{uncertainty in } p_i \sim 30\% \\ \text{uncertainty in } H_1 \sim 10\% \end{cases}$

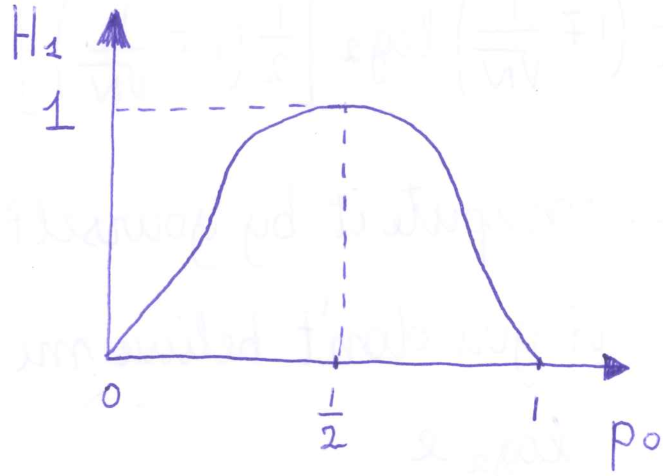
Do you get the point?

$\Rightarrow$ H_1 is much more robust than p_i!

Even when N is as small as ~ 10,

H_1 is very close to 1 !!

- Why is H_1 so robust ?



and so ??

→ What do YOU conclude ?