

Image Correlation

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1 PAPERS FROM GIULIA

On Aug. 30th, 2016 Giulia sent me two papers on correlation techniques. These papers may illuminate a path to find a signal in the pumped Ni circles that Liz made (Ni sample B). She sent me one paper from Nano Letters [1] and one from Science [2]. "The analysis reported in Nano Letters is particularly of interest for our case." - Giulia

1.1 DEFINITION OF THE CROSS-CORRELATION

In the paper by Kwon et. al [1], they define the cross-correlation as:

$$\gamma(t'; t) = \frac{\Sigma_{x,y} C_{x,y}(t) C_{x,y}(t')}{\sqrt{\Sigma_{x,y} C_{x,y}(t)^2 \Sigma_{x,y} C_{x,y}(t')^2}} \quad (1.1)$$

where C is the contrast at times t and t' . The contrast is given by:

$$C_{x,y} = \frac{I_{x,y}(t) - \bar{I}(t)}{\bar{I}(t)} \quad (1.2)$$

where $\bar{I}(t)$ is the mean of $I_{x,y}(t)$.

REFERENCES

- [1] Oh Hoon Kwon, Brett Barwick, Hyun Soon Park, J. Spencer Baskin, and Ahmed H. Zewail. Nanoscale mechanical drumming visualized by 4D electron microscopy. *Nano Letters*, 8(11):3557–3562, 2008.

- [2] Brett Barwick, Hyun Soon Park, Oh-Hoon Kwon, J. Spencer Baskin, and Ahmed H. Zewail. 4D Imaging of Transient Structures and Morphologies in Ultrafast Electron Microscopy. *Science*, 322(11):1227 – 1231, 2008.

1.2 LEFTOVER FROM TEMPLATE

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$$\begin{aligned}(x+y)^3 &= (x+y)^2(x+y) \\ &= (x^2+2xy+y^2)(x+y) \\ &= (x^3+2x^2y+xy^2)+(x^2y+2xy^2+y^3) \\ &= x^3+3x^2y+3xy^2+y^3\end{aligned}\tag{1.3}$$

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1.3 HEADING ON LEVEL 2 (SUBSECTION)

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$$A = \begin{bmatrix} A_{11} & A_{21} \\ A_{21} & A_{22} \end{bmatrix}\tag{1.4}$$

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1.3.1 HEADING ON LEVEL 3 (SUBSUBSECTION)

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2 LISTS

2.1 EXAMPLE OF LIST (3*ITEMIZE)

- First item in a list
 - First item in a list
 - * First item in a list
 - * Second item in a list
 - Second item in a list
- Second item in a list

2.2 EXAMPLE OF LIST (ENUMERATE)

1. First item in a list
2. Second item in a list
3. Third item in a list