Spatial organization of neuroepithelial cells during embryo development

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Pan American Advanced Studies Institute
Buzios, June 2014
Embryonic development

- A few **simple** cell behaviors
  - ... **organized** in **time** and **organized in space**

- One of these behaviors is **proliferation**

- Proliferation not only increases volume but may also generate complex shapes
Biological model

- Chicken central nervous system (Optic Tectum)
What are we searching in these records?

- In general:
  - assess organization in space

- In particular:
  - Are cells distributed just at random?
  - Do correlation exist between the intervals?
  - What kind of correlations?
  - Characterize non-stationarity

✓ Correlations tells us about communications between cells
Data

Intervals

Location of cells

Graph showing data with intervals and location of cells.
Data

Some of the characteristics are:

- around 300 samples long
- non-stationary
- PDF of intervals is far from being Gaussian
Methodology

- Stochastic point process

- Fractal characteristics assessed by estimating Hurst index, scaling index
Methodology

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If \( f(\text{size}) \approx a^H \), \( H \) is the fractal exponent

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Trend estimation and removal before processing
Results
Interpretation of results

- Negative correlations in a wide range of scales
- Global trend

- Proliferating cells communicate with each other
- Their interaction is inhibitory
- Effect of “external control” generates non-stationarity

This is cell by cell approach is much more descriptive approach than the averaged data generally used in Developmental Biology
Future work

- Alternative methods for studying this data set
- Include organization in time
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- Two dimensional data sets
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Thank you!