Learning algorithms and temporal structures for SOM

Presenter: Qian (Courtney) Wu

Supervisor: Tom Gedeon & Leana Copeland
Outlines

• Self Organizing Map

• Spherical SOM

• Apply time series analysis to SSOM – Multiple SSOM

• New approach: Time-Delayed Self-Organizing Maps
SOM – Self Organizing Map

- Unsupervised Competitive learning
- Dimensionality Reduction
- Topological Mapping
- Visualisation Tool

Slide from Lachlan Paget, 2012
SOM – Algorithm

• Initialize the nodes (units) with small random variations

• Randomly choose a input pattern and present to the SOM

• Find the best matching unit (BMU) using some distance measure

• Update the weights of BMU and its neighbor units to make them similar to the input pattern and to each other

• Repeat the process until all patterns are fed to the SOM
Problems with traditional SOM

• Suffer from ‘border effect’
  -- The grid units at the boundary of the SOM have fewer neighbors than the units inside the map
  -- They are thus less likely to be updated compared to the inside units

Solution: Spherical SOM

• Units have equal chances of being updated

• More visually effective – we are more familiar with maps generated from a sphere,
Previous Approach: Multiple Spherical SOM

- Modify learning rule and network topology to incorporate time
- Nodes have neighborhoods spanning multiple spheres

Figure from Songwen, Zha 2011
New Approach: Time-Delayed SOM

---Incorporate time delays to represent sequential data

Methods

- **Average the data** – calculate a backwards exponentially weighted sum then average into one pattern vector
  - Straightforward and easy to implement
  - A bit tricky to decide the time span
  - Following patterns effectively shadow the preceding ones

- **Concatenate the data** – short sequence of input vectors are presented to MSSOM at a same time
  - Straightforward and easy to implement as well
  - Lengthen the training time
  - Better at preserving history knowledge
Questions?