Resultados obtenidos en el año 2011 y líneas futuras

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Índice

International journals and book chapters

1. “Efficient synchronization of structurally adaptive coupled Hindmarsh-Rose neurons”. Chaos Solitons and fractals 44, 11, 929-933 **2011** (5-Year Impact Factor: 1.729)
2. “Energy and information in Hodgking-Huxley neurons”. Physical Review E 83, 031912 **2011** (Impact Factor: 2.35)
3. Enhanced and parameterless Locality Preserving Projections for face recognition. Ambient Intelligence and Smart Environments, Volume 10, 2011. ISBN 978-1-60750-794-9 **2011**.

1- Efficient synchronization of structurally adaptive coupled Hindmarsh-Rose neurons

In this work, we study conditions under which two non-identical electrically coupled neurons can reach an efficient regime of synchronization at low energy cost. We show that:

- the energy consumption required to keep the synchronized regime can be spontaneously reduced if the receiving neuron has adaptive mechanisms able to bring its biological parameters closer in value to the corresponding ones in the sending neuron.

2- Energy and information in Hodgking-Huxley neurons

This paper discusses the interpretation of a Hodgkin-Huxley circuit as an energy model for real biological neurons and uses it to evaluate the consumption of metabolic energy in the transmission of information between neurons coupled by electrical synapses, i.e., gap junctions. We show that:

- for a single postsynaptic neuron maximum energy efficiency requires maximum energy consumption.
- For groups of parallel postsynaptic neurons we determine values of the synaptic conductance at which the energy efficiency of the transmission presents clear maxima at relatively very low values of metabolic energy consumption.

3- Enhanced and parameterless Locality Preserving Projections for face recognition

An improved graph-based linear dimensionality reduction for object recognition is proposed. This method is called enhanced Locality Preserving Projections (LPP), and integrates two interesting properties:

- being entirely parameter-free,
- the mapped data are uncorrelated.

The parameterless computation of the affinity matrix draws on the notion of meaningful and adaptive neighbors. Recognition tasks on five face data sets show a clear improvement over the results of a classical LPP.

Índice

1. Community structure in real-world networks from a non-parametrical synchronization-based dynamical approach. **submitted to Chaos Solitons and fractals, November 2011**
2. On how percolation threshold affects PSO performance. **submitted to The 7th International Conference on Hybrid Artificial Intelligence Systems, January 2012**

1- Community structure in real-world networks from a non-parametrical synchronization-based dynamical approach

This work analyzes the problem of community structure detection in real-world networks based on the synchronization of nonidentical oscillators.

- To enhance the stability of the correlated states that could emerge from the synchronization process, we propose a parameterless mechanism that adapts the characteristic frequencies of coupled oscillators according to a dynamic connectivity matrix deduced from correlated data.
- We show that the characteristic frequency vector that results from the adaptation mechanism reveals the underlying community structure present in the network.

2- On how percolation threshold affects PSO performance.

This work analyzes the influence of neighborhood topology on the performance of particle swarm optimization.
Based on the concept of percolation threshold, and more precisely, the disk percolation model in 2D, we show that better results are obtained for low values of radius, i.e, individuals degree.

Índice

1. Extender los trabajos realizados sobre el consumo energético y la transmisión de información entre neuronas considerando modelos computacionales en neurociencia (computational neuroscience models- ModelDB).
2. Seguir desarrollando algoritmos eficientes de detección de estructuras de comunidad en redes complejas.