



Self-Organised information PrOcessing, CriticaLity and Emergence in multilevel Systems



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Nature processes Information

- Information is registered in the state of a system
- Information is stored, transferred and processed.
- Mapping out exactly how information percolates through the system could reveal new fundamental insights in how the parts orchestrate to produce the properties of the system.
- A theory of information processing would be capable of defining a set of universal properties of dynamical multilevel complex systems





Objectives





Our approach





Information processing

Sophocles

- Shannon Information
- Mutual Information
- Information Dissipation Length or – Time
- Delayed mutual information
- Information synergy
- Fisher Information
- Surprise and Liquidity
- MaxEnt methods

nformation

Processing





Benchmark models

- Elementary Cellular Automata
- Ising models on networks and networks of networks
- Reaction Diffusion models
- Voter models
- Markov models
- Agent based model for cash and goods
- Traffic CAs
- etc.

Information Processing









Computational Exploratory





Bringing it all together





Simulate evolution until time t+delta (using a benchmark model)





data merging

Information Geometry and Fisher Information – the Gray Scott model





Emergence of hierarchies (information slows down growth)

- Top-down and bottom up models
- For top down models, depending on information available to new nodes,
 - the hierarchies grow steadily
 - or growth slows down and stops
- For the bottom up models
 - Average hierarchy level, maximal level, number of edges per node and ratio of so nodes at ground level do not depend 50 on system size (in stationary state), 40 only maximal hierarchy depends on 35 ystem size.

Emergence, self organisation, Tipping Points Logarithmic growth of the number of hierarchy levels in time H(t) for m = 1 and steplike growth for m > 1.







Application to FX rates - 2011 Swiss Sophor National Bank Intervention





Real Data

Workshop and special issue



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		WEDNESDAY 24th - AFTERNOON								 Publication Fees Sections & Collections 	Keywords Published Papers					
<	14:00	IPCS - Information Processing in Complex Systems								Special IssuesEditorial Board	A special issue of <i>Entropy</i> (ISSN 1099-4300).					
	14:00	GSS - Global Sy	stem Science		IMT CHU	IMT LIBRARY (SAN PONZIANO CHURCH)			E-Mail Alert	Deadline	o for manuscript su	ibmissions: 28 Febru	lary 2015			
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	18:00	0 YRNCS - Young researchers network on complex systems - Panel Discussion				CLASSROOM 2 (SAN FRANCESCO)			Journal Browser		Interests: information theory; statistical mechanics; complex systems; complex science; formal languages; information geometry					

Summary



