



# NIT 2014

V International Conference  
Natural Information Technologies  
October 06 - 10, 2014, Madrid (Spain)

Escuela Técnica Superior de Ingeniería de Sistemas Informáticos  
Universidad Politécnica de Madrid

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# NIT 2014

6<sup>TH</sup> – 10<sup>TH</sup> October 2014

Sala de Grados de la Escuela Técnica Superior de Ingeniería  
de Sistemas Informáticos

Universidad Politécnica de Madrid

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## Program

Monday 6<sup>th</sup>

15:00 – 17:00	Registration
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Tuesday 7<sup>th</sup>

First Session	
Moderator: Fernando Arroyo	
9:30 – 10:30	Registration
10:30 – 11:00	Opening Session
11:00 – 11:45	Invited Speaker  <u>José María Sempere</u> Universidad Politécnica de Valencia <i>Formal languages characterization by Networks of Bioinspired Processors</i>
11:45 – 12:15	Coffee break
12:15 – 13:00	Invited Speaker  <u>Mario J. Pérez-Jiménez</u> Universidad de Sevilla <i>Extending a Membrane Computing based modelling framework: Probabilistic Guarded P systems</i>

<b>13:00 – 14:00</b>	<b>Paper presentation</b> <ul style="list-style-type: none"> <li>❖ <i>Microram: a simulation model of a colony of bacteria evolving inside an artificial world</i> Daniel Thai Dam, Rafael Lahoz-Beltra</li> <li>❖ <i>Software effort estimation using radial basis function neural networks</i> Ana Maria Bautista, Angel Castellanos, Tomas San Feliu</li> </ul>
<b>14:00 – 15:30</b>	<b>Lunch</b>

<b>Second session</b>	
<b>Moderator: Santiago Alonso</b>	
<b>15:30 – 16:15</b>	<b>Invited Speaker</b> <u>Agustín Riscos-Núñez</u> <i>MeCoSim: an Integrated Visual Environment for Membrane Computing</i>
<b>16:15 – 18:00</b>	<b>Discussion ITHEA members</b>

## Wednesday 8<sup>th</sup>

<b>First Session</b>	
<b>Moderator: Luis Fernando de Mingo</b>	
<b>10:30 – 11:15</b>	<b>Invited Speaker</b> <u>Víctor Mitrana</u> <i>Extended finite automata over groups</i>
<b>11:15 – 11:45</b>	<b>Coffee break</b>
<b>11:45 – 12:30</b>	<b>Invited Speaker</b> <u>Jorge Navarro</u> <i>Validation of laughter for diagnosis and evaluation of depression</i>
<b>12:30- 13:45</b>	<b>Papers presentation</b> <ul style="list-style-type: none"> <li>❖ <i>Ontontological approach to a simulation system constructing for the particular subject area</i> Zamyatina E.B., Mikheev R.A.</li> <li>❖ <i>RDFArM - a system for storing large sets of rdf triples and quadruples by means of natural language addressing</i> Krassimira Ivanova</li> </ul>
<b>13:45 – 15:00</b>	<b>Lunch</b>

## Second Session

**Moderator: Juan Castellanos**

<b>15:00 – 16:00</b>	<b>Invited speaker</b> <u>Krassimir Markov</u> Institute of Mathematics and Informatics at BAS, Sofia, Bulgaria <i>Collect/Report (CR) NIT Paradigm for Dynamical Processing of Big Data</i>
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Thursday 9<sup>th</sup>

## First Session

**Moderator: Krassimira Ivanova**

<b>10:30 – 11:15</b>	<b>Invited speaker</b> <u>Sandra Gómez</u> <i>Towards a quantitative perspective in NEP</i>
<b>11:15 – 11:45</b>	<b>Coffee break</b>
<b>11:45 – 12:30</b>	<b>Invited speaker</b> <u>Luis F. Macías-Ramos</u> <i>Spiking Neural P Systems: An overview.</i>
<b>12:30 – 13:15</b>	<b>Paper presentation</b>  ❖ <i>Energy versus information</i> Krassimir Markov
<b>13:30 – 15:00</b>	<b>Lunch</b>

## Second Session

**Moderator: Fivos Panetsos**

<b>15:00 – 17:00</b>	<b>Work meeting: ITHEA SIG on Big Data</b>
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Friday 10<sup>th</sup>

<b>10:00</b>	<b>Trip to Alcalá de Henares</b>
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# Invited Conferences Summary

*Formal languages characterization by Networks of Bioinspired Processors*

**DR. JOSE M. SEMPERE LUNA (UNIVERSIDAD POLITÉCNICA DE VALENCIA)**

In this work we will introduce the Networks of Bioinspired Processors as a computation model that can generate or accept strings of a given alphabet. We will give some characterization results from the point of view of descriptive and computational complexity. Then, we will focus our attention to the generation models, and we will show some results about the characterization of formal languages, mainly defined in the Chomsky's Hierarchy, by introducing restrictions in the network topology and the operation functions. Our conclusion will be that the number of processors and the operations inside them are formal aspects that define and characterize language classes.

*Extending a Membrane Computing based modelling framework: Probabilistic Guarded P systems.*

**MARIO J. PÉREZ-JIMÉNEZ**

This talk will be devoted to the development of a methodology to design variants in Membrane Computing which enable the modelling of real-life processes and phenomena. The ecosystem of the species *Pieris Oleracea*, native to eastern North America, will be also presented as a case study, which provoked the extension of the computational formal modelling framework called Multienvironment P systems by the introduction of a new variant: Probabilistic Guarded P systems.

*MeCoSim: an Integrated Visual Environment for Membrane Computing*

**AGUSTÍN RISCOS-NÚÑEZ**

Membrane Computing is a discipline initiated by Gheorghe Paun at the end of 1998. It is a quite active research field, and many variants of their computational devices, the so-called P systems, are presented every year from a theoretical view. For the practical simulation of solutions based on different variants of these devices, P-Lingua framework was developed, being first released in 2008, providing a standard language for P systems, along with parsing and simulation capabilities. MeCoSim (Membrane Computing Simulator) goes one step further on top of P-Lingua, providing a visual environment for working with P system models with integrated tools for P systems designers and end users. These tools includes a broad range of functionalities helping us in the process of modelling, parsing, debugging, design of custom visual applications, analysis and inspection of P systems structure and contents, outputs visualization of tables and charts from the simulation, invariants extractions or verification by model checking.

*Extended finite automata over groups*

**VÍCTOR MITRANA**

We consider a simple and natural extension of a finite automaton, namely an element of a given group is associated with each configuration. An input string is accepted if and only if the neutral element of the group is associated to a final configuration reached by the automaton. The accepting power is smaller when abelian groups are considered, in comparison with the non-abelian groups. We prove that this is due to the commutativity. Each language accepted by a finite automaton over an abelian group is actually a unordered vector language.

We get a new characterization of the context-free languages as soon as the considered group is the binary free group. The result cannot be carried out in the deterministic case. Some remarks about other groups are also presented.

#### *Validation of laughter for diagnosis and evaluation of depression*

**JORGE NAVARRO**

**Background:** In the medical field, laughter has been studied for its beneficial effects on health and as a therapeutic method to prevent and treat major medical diseases. However, very few works, if any, have explored the predictive potential of laughter and its potential use as a diagnostic tool.

**Method:** We registered laughs of depressed patients (n=30) and healthy controls (n=20), in total 934 laughs (517 from patients and 417 from controls). All patients were tested by the Hamilton Depression Rating Scale (HDRS). The processing was made in Matlab, with calculation of 8 variables per laugh positive. General and discriminant analysis distinguished patients, controls, gender, and the association between laughter and HDRS test.

**Results:** Depressed patients and healthy controls differed significantly on the type of laughter, with 88% efficacy. According to the Hamilton scale, 85.47% of the samples were correctly classified in males, and 66.17% in women, suggesting a tight relationship between laughter and the depressed condition.

**Conclusions:** Laughter may be applied as a diagnostic tool in the onset and evolution of depression and, potentially, of neuropsychiatric pathologies. The sound structures of laughter reveal the underlying emotional and mood states in interpersonal relationships.

#### **Collect/Report (CR) NIT Paradigm for Dynamical Processing of Big Data**

**KRASSIMIR MARKOV**

The term "Big Data" refers to large and complex data sets made up of a variety of structured and unstructured data which are too big, too fast, or too hard to be managed by traditional techniques. Big Data is characterized by the 4V-s: volume, velocity, variety, and veracity. Volume refers to the quantity of data, variety refers to the diversity of data types, velocity refers both to how fast data are generated and how fast they must be processed, and veracity is the ability to trust the data to be accurate and reliable when making crucial decisions.

MapReduce is a highly scalable programming paradigm capable of processing massive volumes of data by means of parallel execution on a large number of commodity computing nodes. It was recently popularized by Google, but today the MapReduce paradigm has been implemented in many open source projects, the most prominent being the Apache Hadoop.

In the Big Data community, MapReduce has been seen as one of the key enabling approaches for meeting the continuously increasing demands on computing resources imposed by massive data sets. At the same time, MapReduce faces a number of obstacles when dealing with Big Data including the lack of a high-level language such as SQL, challenges in implementing iterative algorithms, support for iterative ad-hoc data exploration, and stream processing.

Collect/Report (CR) Paradigm is a Natural Information Technology for Dynamical Processing of Big Data. It is inspired from the human brain features to collect dynamically big amount of information and to report it when it is requested. CR is based on NL-Addressing aimed just to extend possibilities for storing and processing Big Data in direction of implementing iterative algorithms, support for iterative ad-hoc data exploration, and stream processing which are not covered by MapReduce paradigm.

*Towards a quantitative perspective in NEP*

**SANDRA GÓMEZ CANAVAL**

Network of Evolutionary Processors -NEP is a computational model inspired by the evolution of cell populations, which might model some properties of evolving cell communities at the syntactical level. Formally, NEP is based on an architecture for parallel and distributed processing. NEP is efficient, universal, and computationally complete. Nevertheless, although the NEP model is biologically inspired, this model is mainly motivated by mathematical and computer science goals. In this context, the biological aspects are only considered from a qualitative and syntactical perspective. In view of this lack, it is important to try to keep the NEP theory as close as possible to the biological reality, extending their perspective incorporating the interplay of qualitative and quantitative aspects.

A new era of the NEP model appears. Then, the quantitative character of the NEP model is mandatory and it can address completely new different types of problems with respect to the classical computational domain. In this talk, novelty aspects defining the step from the NEP to the Quantitative NEP (QNEP) are introduced.

*Spiking Neural P Systems: An overview.*

**LUIS F. MACÍAS-RAMOS**

Abstract: Spiking Neural P systems (SN P systems) are one of the main 'flavours' of P systems, the computational devices of Membrane Computing. SN P systems abstract the neurological structure of living beings in order to provide computational devices to tackle hard problems. In this talk we will enjoy an overview on these systems: theory, simulation and real-life applications will be covered.

# Alcalá de Henares, Spain

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Alcalá de Henares (Spanish pronunciation: [alkaˈla ðe eˈnares]), meaning Citadel on the river Henares, is a Spanish city whose historical centre is one of UNESCO's World Heritage Sites. The city stands out for its rich archaeology and was one of the first bishoprics founded in Spain. Located in the Autonomous Community of Madrid, 35 kilometres (22 miles) northeast of the city of Madrid, at an altitude of 588 m (1,929 ft) above sea level, it has a population of around 200,000, the second largest of the region after the Spanish capital itself. Locally, the city is generally known simply as "Alcalá", but "de Henares" is appended when needed to differentiate it from a dozen Spanish cities sharing the name Alcalá. The Latin name, Complutum, is sometimes used. The city is capital of its namesake region, Comarca de Alcalá.

## **History**

The city boundaries have been inhabited since the Calcolithic phase of the Bronze Age. Romans conquered the area in the 1st century BC, and built the town of Complutum near a previous Celtiberian settlement, called Iplacea. Thus, it became the only Roman town in the Madrid region. With 10,000 inhabitants, it reached the status of Municipium and had its own governing institutions. After the downfall of the Roman Empire, under the Visigoths, it declined, although it also became a pilgrimage destination in remembrance of the Saints Justo and Pastor.

When the Moors arrived in 711, they subdued the Visigothic city and founded another site, building an al-qal'a, which means "citadel" in Arabic, on a nearby hill, today known as Alcalá la Vieja (Old Alcalá). On 3 May 1118, it was reconquered by the Archbishop of Toledo Bernard de Sedirac in the name of Castile. The Christians preferred the Burgo de Santiuste ("Saint Just's borough") on the original Roman site and the Arab one was abandoned. The city was ceded to the Bishopric of Toledo, which granted it ferial rights. Under Christian rule until the end of the Reconquista, the city had both a Jewish and a Moorish quarter and a renowned marketplace. Its central position allowed it to be a frequent residence of the Kings of Castile, when travelling south.

At some time in the 1480s, Christopher Columbus had his first meeting at the "Casa de la Entrevista" with the Reyes Católicos, Ferdinand and Isabella, who financed the travel for the Discovery of America.

The city suffered severe damage during the Spanish Civil War.

## **Climate**

The climate in this city of central Spain is the continentalised Mediterranean, with cold, dry winters and hot, dry summers. Rains fall mainly in spring and autumn. Temperatures vary from some degrees below 0 °C (32 °F) in December and January to some over 40 °C (104 °F) in July and August.

## **Transport**

Alcalá's excellent transport links with Madrid have led to its becoming a commuter town, with many of its inhabitants travelling to work in the capital. It was affected particularly badly by the 11 March 2004 Madrid train bombings in Madrid as all the bombs were placed



on trains that originated in, or passed through, Alcalá. There is now a memorial placed at the entrance to the station in remembrance of the victims.

Alcalá also has an intensive bus system called "Alcalá-Bus" which runs to all the major neighborhoods and costs 1,30 euro per ride.



Cervantes Square



The plateresque façade of the old Alcalá University



Laredo Palace



Statues of Don Quixote and Sancho Panza outside Cervantes' birthplace

### ***Geography***

At an average of 654 m of altitude, on the southern part of the Meseta Central and occupying some 88 km<sup>2</sup>; the city was for a long time encapsulated between the hills and the river Henares to the south and east by the Madrid-Barcelona railway on the north and west. However, the expanding population has forced two new residential areas to be created between the railway and the motorway and beyond the latter. The historical centre lies roughly in the middle of the urban area. It is characterised by lower, Spanish Golden Age buildings, of which the most lavish belong to the University. These historic buildings gained for the city the title of World Heritage Site, awarded by the UNESCO in 1998.

Surrounding it there are the high, swiftly built blocks of the 1960s, during the Francoist era. They fill spaces to the north up to the railway line and to the west up to where the industrial zone begins. This was erected in the early 1960s and has developed and expanded. Now it

occupies more than a third of the city's area being cut by the railway and motorway. To the east, the old blocks limit with a more recent area of lower blocks with gardens and semi-detached houses. This kind of construction also makes up the landscape of the new districts beyond the railway and the motorway.

The river remains widely underused. Although there are plans now in force to reconvert it into a major leisure place for the *alcalaínos*, it still presents no more than fairly good tracks for cycling and walking.

### ***The city today***

The center of the city remains essentially medieval, with many winding cobbled streets, and many historic buildings. The city centre surrounds Cervantes Square (the famous Plaza de Cervantes) and is traversed by a long pedestrian main street, the Calle Mayor. The city includes the Moorish quarter, the Jewish quarter, and the Christian quarter. These distinct neighborhoods have given Alcalá the reputation of "the city of three cultures."

The old city centre has been largely preserved, unlike the suburbs. There has been no clear planning by the city councillors regarding expansion, and the sprawling suburban areas are irregularly constructed, with the addition of 1970s-style high rise blocks in many places.

One of the most important streets in the city is the Calle del Cardenal Cisneros which takes tourists from the Madrid Gate at the entrance of the city, to the old city center and the Cathedral in Santos Niños Square. The main park of Alcalá, Parque Municipal O'Donnell is a major recreational center for city residents and lies along a main road of Alcalá, Vía Complutense.

Recent archaeological excavations have opened up the city's Roman forum where a large complex comprising a basilica, public baths, a cryptoporticus, a market and a large monumental façade stands out. Alongside the forum is the Domus with an extraordinary collection of Roman domestic mural paintings. On the outskirts is the House of Hippolytus, an old school. In turn, the Regional Archaeology Museum holds highly valuable mosaics.

The city hosts a large population of international students due to the presence of the University, and in particular its Spanish language and literature programs for foreign students. *Alcalingua*, a branch of University of Alcalá, is one of the major foreign language learning centers for students from abroad.