

12<sup>th</sup> International Workshop

on Graph Based Representations

ON GRAPH BASED REPRESENTATIONS

# GbR 2019

19-21 Jun 2019 – Tours (FR)

## Program Booklet





**12th IAPR INTERNATIONAL  
WORKSHOP ON  
GRAPH based REPRESENTATIONS**



**Tours – Loire Valley, France  
Ecole Polytechnique de l'Université de Tours  
June 19<sup>th</sup>-21<sup>th</sup>, 2019**

<https://gbr2019.sciencesconf.org/>





# Committees

## Workshop Chairs

Donatello Conte	<i>University of Tours – France</i>
Jean-Yves Ramel	<i>University of Tours – France</i>
Pasquale Foggia	<i>University of Salerno – Italy</i>

## Organizing Committee

Donatello Conte	<i>University of Tours – France</i>
Jean-Yves Ramel	<i>University of Tours – France</i>
Romain Raveaux	<i>University of Tours – France</i>
Christelle Grange	<i>University of Tours – France</i>
Annie Simon	<i>University of Tours – France</i>
Sabine Barrat	<i>University of Tours – France</i>
Zeina Abu-Aisheh	<i>University of Caen – France</i>

## Program Committee

### *Academic members*

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Luc Brun	<i>Normandie University, UNICAEN, ENSICAEN, CNRS, GREYC, France</i>
Ananda S. Chowdhury	<i>Jadavpur University, India</i>
Donatello Conte	<i>Computer Science Laboratory (LIFAT EA 6300), Tours, France</i>
Guillaume Damiand	<i>CNRS/LIRIS/Université de Lyon, France</i>
Francisco Escolano	<i>University of Alicante, Spain</i>
Pasquale Foggia	<i>University of Salerno, Italy</i>
Benoit Gaüzère	<i>Normandie Université, INSA de Rouen, LITIS, France</i>
Giuliano Grossi	<i>University of Milan, Italy</i>
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Pierre Héroux	<i>Université de Rouen - LITIS EA 4108, France</i>
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Josep Lladós	<i>Computer Vision Center, Universitat Autònoma de Barcelona, Spain</i>
Bin Luo	<i>Anhui University, China</i>
Jean-Marc Ogier	<i>University of La Rochelle, Laboratoire L3i, France</i>
Marcello Pelillo	<i>University of Venice, Italy</i>
Jean-Yves Ramel	<i>Computer Science Laboratory (LIFAT EA 6300), Tours, France</i>
Romain Raveaux	<i>Computer Science Laboratory (LIFAT EA 6300), Tours, France</i>
Kaspar Riesen	<i>University of Applied Sciences and Arts Northwestern Switzerland</i>
Francesc Serratos	<i>Universitat Rovira i Virgili, Spain</i>
Christine Solnon	<i>LIRIS CNRS UMR 5205/INSA Lyon, France</i>
Salvatore Tabbone	<i>Université de Lorraine, France</i>
Andrea Torsello	<i>Università Ca Foscari, Italy</i>
Ernest Valveny	<i>Computer Vision Center - Universitat Autònoma de Barcelona, Spain</i>
Mario Vento	<i>Università degli Studi di Salerno, Italy</i>
Richard Wilson	<i>University of York, UK</i>

## Message from the General Chairs

Our warmest welcome to the 12th IAPR-TC15 Workshop on Graph-based Representations in Pattern Recognition (GbR) in Tours.

In GbR, 22 papers has been accepted and presented orally. Each submission was reviewed by at least two and usually three Program Committee members.

The program also included 2 very interesting invited talks: one by Christine Solnon, from the INSA of Lyon, that presented a talk entitled “Experimental Evaluation of Subgraph Isomorphism Solvers”; one by Marco Gori, from the University of Siena, that presented a talk entitled “Local Propagation in Graphical Neural Networks”.

Accepted papers mainly cover the following topics: Graph Edit Distance, Graph Matching, Machine Learning for Graph problems, Network and Graph Embedding, Spectral Graph Problems, Parallel Algorithms for Graph Problems.

Numerous applications have been addressed with the help of graph-based representations, ranging from fMRI applications, Image and Video Processing, to Social Networks analysis, Document analysis, Chemio-informatics and Classification problems.

Authors of selected papers were invited to submit an extended version to a *Special Issue on "Advances in Graph-based Representations for Pattern Recognition"* to be published in *Pattern Recognition Letters* in 2020.

The Computer Science Laboratory of University of Tours in France (LIFAT) hosts the GbR 2019 workshop. We acknowledge the generous support from the city of Tours, the French Region Centre Val de Loire, the University of Tours and the Engineering School of the University, the research federation ICVL and APSIDE company.

We would like to thank all the Program Committee members for their help in the review process. We also wish to thank all the local organizers. Without their contributions, GbR 2019 would not have been successful.

We hope you will find your stay fruitful and rewarding. We trust that you will enjoy the exchange of technical and scientific ideas during the three days of GbR 2019 as well as getting a flavor of the city of Tours and the Loire Valley, which are one of the most famous and most beautiful tourist destinations in France. We extend our warmest welcome to you, and hope that your visit will be a memorable one!

Donatello Conte, Jean-Yves Ramel and Pasquale Foggia  
GbR 2019 General Chairs

## Venue & Practical Information

GbR 2019 will take place in the Polytech'Tours School, Tours, France.



The Polytech'Tours School stands at the sud of Tours-City in a Business-Education Area of the City easily reachable by Tram (see next Page for details).

All the **oral sessions** will be held in **the Alan Turing room** at the ground floor.

**Lunch** will be served in the **Ada Lovelace room** at the ground floor.

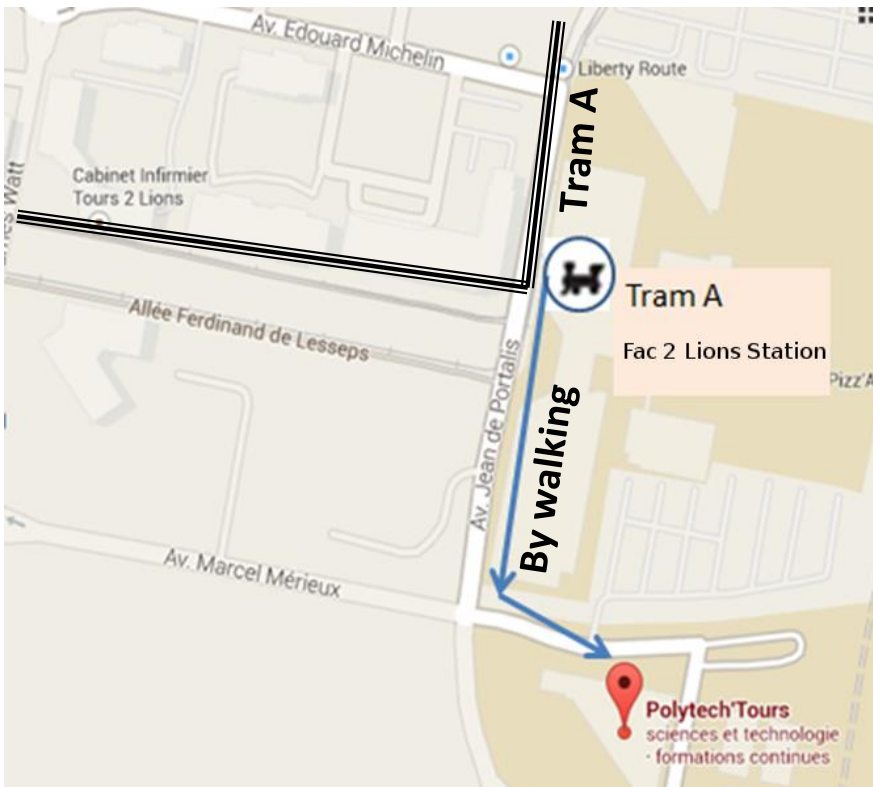
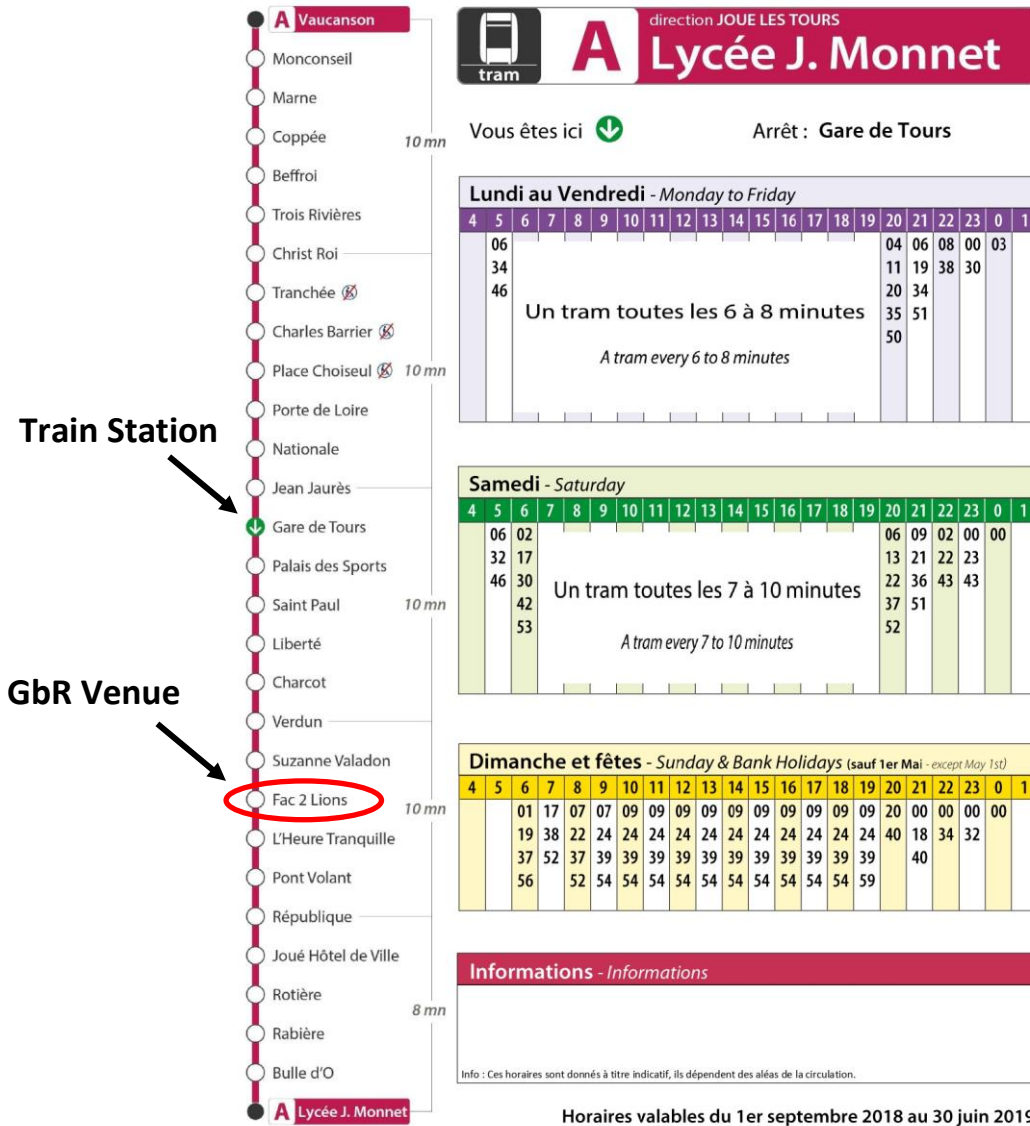
Attendees will have a space at their disposal to deposit their things in the **Charles Babbage room**.

### Registration desk:

<b>Time</b>	<b>Location</b>	<b>Phone</b>
From Wednesday 19 <sup>th</sup> June to Friday 21 <sup>th</sup> June 8h30-12h and 13h45-16h	Polytech'Tours school (Tours)	02 47 36 14 42



# Tours city (Train Station) → Polytech'Tours (by Tramway)



# General Map

The map displays the city of Tours with the Loire river on the left. A red line labeled 'Direct Tramway A' runs from the center towards the east. Key locations are marked with icons and arrows pointing to inset photos:

- Old City:** Located in the top left, showing traditional half-timbered buildings.
- Tours University Library:** Located in the top right, showing a large, ornate building.
- Polytech Tours School:** Located in the bottom left, showing a modern multi-story building.
- Railway Station Tours City:** Located in the bottom right, showing a large, arched station entrance.

Other labeled streets include Rue Mirabeau, Rue de la Fuye, Bd Heurteloup, Rue Léon Boyer, Bd Béranger, Av de Grammont, Rue Febrère, Rue Auguste Chevallier, Rue Giraudeau, Bd Jean Monnet, Bd Louis XI, Rue Febvotte, Rue Jean Royer, Rue de la Fuye - VELPEAU, QUARTIER DU SANITAS, SAINT-SAUVEUR, and Route de Saint-Avé. Landmarks like 'Cathédrale Saint-Gatien', 'Les Halles de Tours', 'Hôtel de Ville - Tours', 'Jardin des Prébendes d'Oé', 'Parc du Lac de la Bergeonnerie', and 'Cinéma CGR Tours 2 Lions' are also visible.

**Tours University Library**  
3 Rue Monseigneur Marcel  
**Welcome Cocktail Venue**

**Railway Station Tours City**

**Old City**

**Polytech Tours School**  
64 Avenue Jean Portalis  
**Gbr Venue**

## Invited Talks



LIRIS Lab – INSA Lyon - France

### *Experimental Evaluation of Subgraph Isomorphism Solvers*

Prof Christine SOLNON

Subgraph Isomorphism (SI) is an NP-complete problem which is at the heart of many structural pattern recognition tasks as it involves finding a copy of a pattern graph into a target graph. In the pattern recognition community, the most well-known SI solvers are VF2, VF3, and RI. SI is also widely studied in the constraint programming community, and many constraint-based SI solvers have been proposed since Ullman, such as LAD and Glasgow, for example. All these SI solvers can solve very quickly some large SI instances, that involve graphs with thousands of nodes. However, McCreesh et al. have recently shown how to randomly generate SI instances the hardness of which can be controlled and predicted. In particular, they have shown how to generate small instances (with thirty pattern nodes and 200 target nodes, for example) which are computationally challenging for all solvers. This study also showed that some small instances which are easily solved by constraint-based solvers, appear to be challenging for VF2 and VF3. In this talk, we will widen this study by considering a large test suite of 14,621 instances coming from eight different benchmarks.

We will show that, as expected for an NP-complete problem, the solving time of an instance does not depend on its size, and that some small instances coming from real applications are not solved by any of the considered solvers. We will also show that, if RI and VF3 are able to solve very quickly a large number of easy instances, for which Glasgow or LAD need more time, they fail at solving some other instances that are quickly solved by Glasgow or LAD, and they are clearly outperformed by Glasgow on hard instances. Finally, we will show that we can easily combine solvers to take benefit of their complementarity.





Siena Artificial Intelligence Lab – University of Siena - Italy

### ***Local Propagation in Graphical Neural Networks***

Prof Marco GORI

The indisputable success of deep learning mostly relies on vector-based representations of the inputs. Yet, many applications deal with non-Euclidean data that typically exhibit a graph structure. Examples come from very different domains, including social networks, molecular graphs in chemistry, and computer vision. In the last couple of years, the extension of neural computation to graphical domains, that was brought to the attention of the scientific community at the end of nineties, has come back to life thanks to a small community of scientists, who have significantly contributed to improve the algorithmic framework and, especially, to show remarkable experimental achievements in different application domains.

In this talk, we begin noticing that, apart from the above mentioned advances, the underlying idea behind the process of learning the weights is still based on an appropriate extension of Backpropagation to graphs. As such, we are still in front of a computational process that has been the source of many debates on its arguable biological plausibility. Then, we propose a novel reformulation of learning in graphical domains that is based on the description of the given graphs and of the neural network by a correspondent set of constraints that must be “parsimoniously satisfied.” We propose a Lagrangian framework that gives rise to a biologically plausible local algorithm based on the search for saddle points in the learning adjoint space (LAS) composed of weights, neural outputs, and Lagrangian multipliers. This Local Propagation algorithm (LP) only involves local updates of the weights. Preliminary experiments are shown to illustrate the features and the performance of this novel local propagation learning algorithm. Interestingly, the learning of LP in the LAS also allow us to circumvent the classic problem of gradient vanishing in deep sequences.

## Program at glance

	Wednesday 19th June	Thursday 20th June	Friday 21th June
<b>9h</b>	Opening	Invited Talk: M. Gori	Parallel computing for graph applications
<b>9h15</b>	Invited Talk: C. Solnon		
<b>10h</b>	Break	Break	Break
<b>10h15</b>			
<b>10h30</b>	Graph Embedding	Graph Edit Distance	Graph-based Applications
<b>10h45</b>			
<b>12h</b>	Lunch	Lunch	Lunch
<b>12h15</b>			
<b>12h30</b>			
<b>13h</b>			
<b>13h30</b>	Graph-based Representation	Graph Matching	Spectral vs Mathematical Programming Methods for Graph-based Applications
<b>14h</b>			
<b>14h30</b>			
<b>15h</b>	Break	Social Event	Closing
<b>15h30</b>			
<b>16h</b>	TC15 Meeting		
<b>16h30</b>			
<b>17h30</b>			
<b>18h</b>			
<b>18h30</b>			
<b>19h30</b>	Welcome Cocktail		
<b>21h30</b>			
<b>22h</b>			
<b>23h</b>			

**Wednesday, June 19, 2019**

**Turing Amphitheater – Polytech’Tours**

**9:00**  
**9:15**

**Opening**

**9:15**      **Experimental Evaluation of Subgraph Isomorphism Solvers**  
**10:15**      *Prof Christine SOLNON - LIRIS Lab – INSA Lyon - France*

Session chair: Luc Brun

**10:15**      **Coffee break**  
**10:45**      (Lovelace Room)

**10:45**      **Graph Embedding**  
**12:15**

Session chair: Jean-Yves Ramel

10:45      #25 - Network Embedding by Walking on the Line Graph  
11:15      *Miguel Angel Lozano, Manuel Curado Navarro, Francisco Escolano and Edwin Hancock*

11:15      #21 - An Attributed Graph Embedding Method using the Tree-Index Algorithm  
11:45      *Yuhang Jiao, Yueting Yang, Lixin Cui and Lu Bai*

11:45      #16 - On-line Learning the Edit Costs based on an Embedded model  
12:15      *Elena Rica, Susana Álvarez and Francesc Serratosa*

**12:15**      **Lunch**  
**13:30**      (Lovelace Room)

**13:30**      **Graph-based Representation**  
**15:30**

Session chair: Francesc Serratosa

13:30      #17 - Congratulations! Dual graphs are now orientated!  
14:00      *Darshan Batavia, Walter Kropatsch, Rocio Gonzalez-Diaz and Rocio Moreno Casablanca*

14:00      #15 - An hypergraph data model for expert finding in Multimedia Social Networks  
14:30      *Vincenzo Moscato, Antonio Picariello and Giancarlo Sperli*

14:30      #13 - Event Prediction based on Unsupervised Graph-Based Rank-Fusion Models  
15:00      *Icaro Dourado, Salvatore Tabbone and Ricardo Torres*

15:00      #22 - A Graph-theoretic Framework for Summarizing First-Person Videos  
15:30      *Ananda Chowdhury and Abhimanyu Sahu*

**15:30**      **Coffee break**  
**16:00**      (Lovelace Room)

**16:00**      **TC15 Meeting**

**19:30**      **Welcome Cocktail**

## Welcome Cocktail

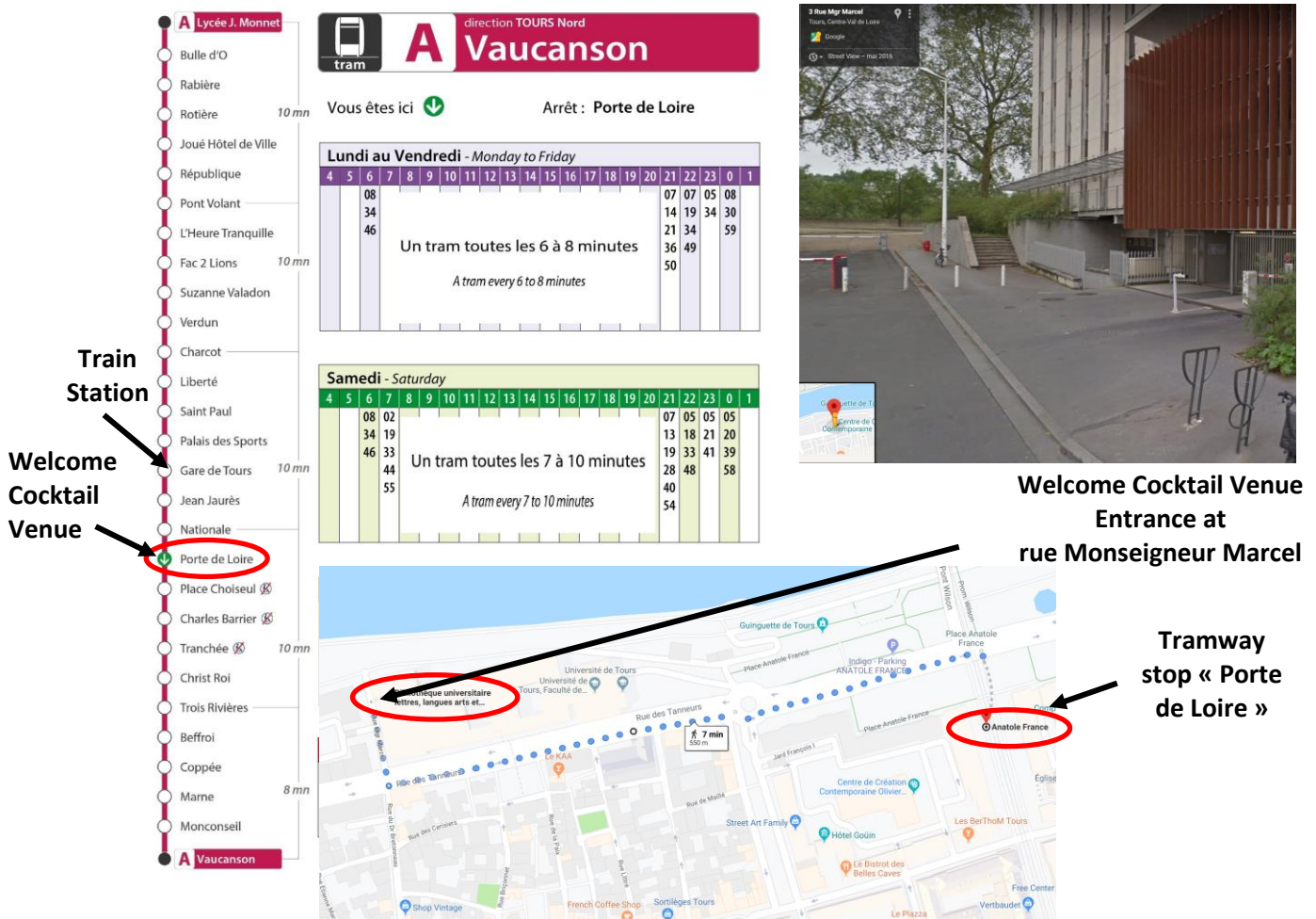
The welcome reception will be at the University Library in Tours city center (rue Monseigneur Marcel, 37000 Tours). From there you can enjoy a great view of the City and the Loire river.

At this venue, it will be possible to experience typical local food (cheeses) and wine degustation.



## Practical Information to reach Welcome Cocktail Venue

To reach the Welcome Cocktail Venue at University Library you can take the tramway. From the train station, you have to take the tramway in the direction to Vaucanson, and get out at the stop “Porte de Loire” (see Figure below) and then you can walk until the entrance at “rue Monseigneur Marcel” (see Roadmap below). At the entrance there will be a security guard, please tell your name and he will show you the lift to go up at the University Library.



**Thursday, June 20, 2019**

**Turing Amphitheater – Polytech’ Tours**

**IAPR Invited Talk**

**9:00**     **Local Propagation in Graphical Neural Networks**  
**10:00**     *Prof Marco GORI - Siena Artificial Intelligence Lab – University of Siena - Italy*  
Session chair: Pasquale Foggia

**10:00**     **Coffee break**  
**10:30**     (Lovelace Room)

**Graph Edit Distance**

**10:30**     **12:00**     Session chair: Andreas Fischer

10:30     #14 - Generalized Median Graph Via Iterative Alternate Minimizations  
11:00     *Nicolas Boria, Sébastien Bogleux, Benoit Gaüzère and Luc Brun*

11:00     #2 - Learning the Graph edit costs: What do we want to optimize?  
11:30     *Elena Rica, Susana Álvarez and Francesc Serratos*

11:30     #1 - GEDLIB: A C++ Library for Graph Edit Distance Computation  
12:00     *David B. Blumenthal, Sébastien Bogleux, Johann Gamper and Luc Brun*

**12:00**     **Lunch**  
**13:30**     (Lovelace Room)

**Graph Matching**

**13:30**     **14:30**     Session chair: Walter Kropatch

13:30     #3 - Sub-optimal Graph Matching by Node-to-node Assignment Classification  
14:00     *Xavier Cortés, Donatello Conte and Francesc Serratos*

14:00     #4 - Cross-Evaluation of Graph-based Keyword Spotting in Handwritten Historical Documents  
14:30     *Michael Stauffer, Paul Maergner, Andreas Fischer and Kaspar Riesen*

**14:30**     **Social Event**



## Social Event



The social event will be divided in two parts: one will be the visit of the Chenonceau castle, and the second one will be a dinner on a restaurant boat.

We will get on the bus at the GbR Venue just after the last session. At the end the bus will bring us back to Tours City.



On board of the restaurant boat LA BELANDRE, come and discover Le Château de Chenonceau in another way. A live commentary is said on board by the guide.

You will discover the Cher from Chisseaux en Touraine (2 km away from Chenonceau), a sinuous and romantic river that skirts forested and vine-covered slopes, right underneath the arches and past the world's largest and most sumptuous Renaissance mansion (built over a river) : CHENONCEAU.

**Friday, June 21, 2019**

**Turing Amphitheater – Polytech’Tours**

**9:00** **Parallel computing for graph applications**  
**10:00** Session chair: Pierre Héroux

9:00 #20 - A parallel MCMC algorithm for the Balanced Graph Coloring problem  
9:30 *Donatello Conte, Giuliano Grossi, Raffaella Lanzarotti, Jianyi Lin and Alessandro Petrini*

9:30 #18 - Solving subgraph isomorphism through parallel state-space search  
10:00 *Vincenzo Carletti, Pasquale Foggia, Pierluigi Ritrovato, Mario Vento and Vincenzo Vigilante*

**10:00** **Coffee break**  
**10:30** (Lovelace Room)

**10:30** **Graph-based Applications**  
**12:30** Session chair: Ananda S. Chowdury

10:30 #12 - A Database and Evaluation for Classification of RNA Molecules using Graph Methods  
11:00 *Enes Algul and Richard Wilson*

11:00 #19 - Local Binary Pattern based Graph Construction for Hyperspectral Image Segmentation  
11:30 *Kaouther Tabia, Xavier Desquesnes, Yves Lucas and Sylvie Treuillet*

11:30 #26 - Discriminant Manifold Learning with Graph Convolution Based Regression for Image classification  
12:00 *Ruifeng Zhu, Fadi Dornaika and Yassine Ruichek*

12:00 #28 - Graph-based representations for supporting genome data analysis and visualization: Opportunities and Challenges  
12:30 *Vincenzo Carletti, Pasquale Foggia, Erik Garrison, Luca Greco, Pierluigi Ritrovato and Mario Vento*

**12:30** **Lunch**  
**13:30** (Lovelace Room)

**13:30** **Spectral Methods vs Mathematical Programming Methods for Graph-based Applications**  
**15:30** Session chair: Edwin Hancock

13:30 #6 - Solving the graph edit distance problem with variable partitioning local search  
14:00 *Mostafa Darwiche, Donatello Conte, Romain Raveaux and Vincent T'Kindt*

14:00 #24 - Reconstructing objects from noisy images at low resolution  
14:30 *Helene Svane and Aasa Feragen*

14:30 #5 - Graph Edge Entropy in Maxwell-Boltzmann Statistics for Alzheimer's Disease Analysis  
15:00 *Jianjia Wang, Richard Wilson and Edwin Hancock*

15:00 #23 - Network Time Series Analysis using Transfer Entropy  
15:30 *Ibrahim Caglar and Edwin Hancock*

**15:30** **Closing**



## Programs for accompanying people

There are numerous attractions in and around Tours city and Loire Valley for accompanying people. Customized half-day or full-day trips in Touraine / Loire Valley can be organized by many local incoming agencies. But it is also possible to organize the visits by yourself by using buses, train or by renting a car.

Not to be missed:

- The impressive medieval and Renaissance heritage (castles, rivers, vineyards, ...)
- Local wines and gastronomy : A richness in gastronomy with several traditional restaurants cooking local high-quality products such as goat cheese, pork specialties, vegetables and fruits,
- The Loire valley possesses some well-known wines and vineyards like Chinon, Bourgueil... for red wines and Vouvray, Montlouis for white and sparkling wines....
- Residences of famous artists: Leonardo da Vinci, Rabelais, Balzac, Ronsard, Calder

Furthermore, original activities for incentives and team building: cooking courses in chateaux, treetop adventure trails, oenological games, dune buggy tours in the vineyards, balloon flights for small groups, quad bikes, canoe, golf, cycling “on the Loire by Bike” itineraries...

Examples of possible tours (please visit <http://www.tours-tourism.co.uk/> for more information)

- The castles of the Loire valley by minibus from Tours, all inclusive Châteaux in Loire Valley and Vineyards by minibus, private tour in Loire Valley Minibuses 9 seats, Castles by air
- Visit of Tours city organized by the Tourist Office of Tours
- Museums in Tours
- Parks and Garden in Tours





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