

SSPR 2010 Special Session

SIMILARITY-BASED PATTERN RECOGNITION: CHALLENGES AND PROSPECTS



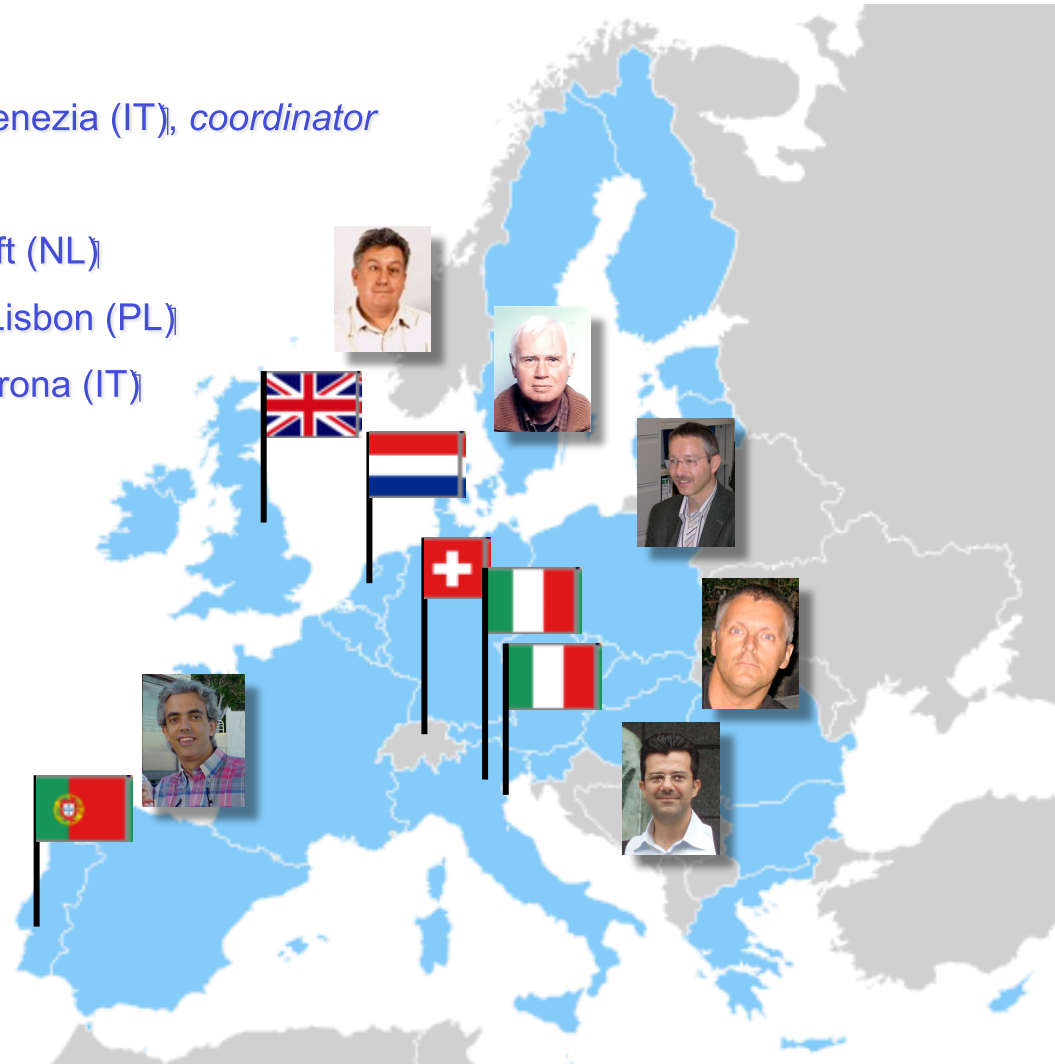


The SIMBAD FP7 Project

Beyond Features: Similarity-Based Pattern Analysis and Recognition



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Pattern Recognition and Hume's Similarity Principle

« I have found that such an object has always been attended with such an effect, and I foresee, that other objects, which are, in appearance, similar, will be attended with similar effects. »

David Hume

An Enquiry Concerning Human Understanding
(1748)





The Classical “Feature-based” Approach and Its Limitations

Traditional pattern recognition techniques are centered on the notion of **feature**, i.e. they *derive similarities from vector representations*.

But, there are various application domains where either it is not possible to find satisfactory features or they are inefficient for learning purposes.

This is typically the case, e.g.,

- when experts cannot define features in a straightforward way
- when data are high dimensional
- when features consist of both numerical and categorical variables,
- in the presence of missing or inhomogeneous data
- when objects are described in terms of structural properties, such as parts and relations between parts, as is the case in shape recognition



Beyond features?

By departing from vector-space representations one is confronted with the challenging problem of dealing with (dis)similarities that do not necessarily possess the Euclidean behavior or not even obey the requirements of a metric.

The lack of the Euclidean and/or metric properties undermines the very foundations of traditional pattern recognition theories and algorithms!



Objectives of SIMBAD

SIMBAD aims at bringing to full maturation a paradigm shift that is currently just emerging within the pattern recognition and machine learning domains, where researchers are becoming increasingly aware of the importance of similarity information *per se*, as opposed to the classical feature-based approach.

The whole project will revolve around two main themes, which basically correspond to the two fundamental questions that arise when abandoning the realm of vectorial representations, namely:

- How can one **obtain** suitable similarity information from object representations that are more powerful than, or simply different from, the vectorial?
- How can one **use** similarity information in order to perform learning and classification tasks?



The structure of SIMBAD

- 1. Deriving similarities for non-vectorial data**
 - *Structural (generative/compression) kernels*
 - *Learning and combining similarities*

- 2. Learning and classification with non-(geo)metric similarities**
 - *Foundations of non (geo)metric similarities*
 - *Imposing geometricity on non-geometric similarities (embedding)*
 - *Learning with non-(geo)metric similarities (game theory)*

- 3. Biomedical applications**
 - *Analysis of tissue micro-array (TMA) images of renal cell carcinoma*
 - *Analysis of brain magnetic resonance (MR) scans for the diagnosis of mental illness*



For more information:

<http://simbad-fp7.eu>

Simbad Project - Mozilla Firefox

File Modifica Visualizza Cronologia Segnalibri Strumenti ?

http://simbad-fp7.eu/index.php

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SIMBAD

Beyond Features
Similarity-based pattern analysis and recognition

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About SIMBAD

Traditional pattern recognition techniques are centered around the notion of "feature". According to this view, the objects to be classified are represented in terms of properties that are intrinsic to the object itself. Hence, a typical pattern recognition system makes its decisions by simply looking at one or more feature vectors provided as input. The strength of this approach is that it can leverage a wide range of mathematical tools ranging from statistics, to geometry, to optimization. However, in many real-world applications a feasible feature-based description of objects might be difficult to obtain or inefficient for learning purposes. In these cases, it is often possible to obtain a measure of the (dis)similarity of the objects to be classified, and in some applications the use of dissimilarities (rather than features) makes the problem more viable. In the last few years, researchers in pattern recognition and machine learning are becoming increasingly aware of the importance of similarity information per se. Indeed, by abandoning the realm of vectorial representations one is confronted with the challenging problem of dealing with (dis)similarities that do not necessarily obey the requirements of a metric. This undermines the very foundations of traditional pattern recognition theories and algorithms, and poses totally new theoretical and computational questions. In this project we aim at undertaking a thorough study of several aspects of purely similarity-based pattern analysis and recognition methods, from the theoretical, computational, and applicative perspective. We aim at covering a wide range of problems and perspectives. We shall consider both supervised and unsupervised learning paradigms, generative and discriminative models, and our interest will range from purely theoretical problems to real-world practical applications.

Information and Communication
Technologies
Collaborative Project
FET Open

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Journal Special Issue: *Learning in Non-(geo)metric Spaces*

JMLR (?)

Tentative Schedule:

Proposal submission:	Next few days...
Call for Papers issued.	End of Summer 2010
Submission deadline:	October 2010
1st reviews:	March 2011
Revised papers:	July 2011
2nd reviews/decisions:	October 2011
Publication:	Early 2012

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The SIMBAD Workshop Series

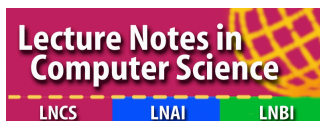


The first edition of the workshop (***SIMBAD 2011***) will take place in Italy, in the (late) spring of 2011, at the end of the project (in conjunction with the final SIMBAD meeting).

Format:

- a few invited talks
- contributed oral/poster presentation
- panel discussion

Call for Papers issued early in summer 2010.



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Schedule

09:10 – 09:30	L. Han, R. Wilson, and E. R. Hancock <i>Generative Models for Relational Structures</i>
09:30 – 09:50	M. Loog et al. <i>Dissimilarity-based Classification of MRIs for Early Diagnosis of Dementia</i>
09:50 – 10:10	F. Escolano, E. R. Hancock, and M. A. Lozano <i>Graph Similarity, I-Divergences and Entropic Manifold Alignment</i>
10:10 – 10:30	<i>Coffee break</i>
10:30 – 10:50	A. Carli, M. Bicego, S. Baldo, and V. Murino <i>Nonlinear Mappings for Generative Kernels on Latent Variable Models</i>
10:50 – 11:10	D. R. Kisku <i>Complexity Analysis of Multi-View Face Recognition System</i>
11:10 – 11:30	A. Torsello <i>A Game-Theoretic Approach to Robust Inlier Selection</i>
11:30 – 12:30	Panel discussion Panelists: <i>N. Ahuja, H. Bunke, E. Estrada, J. Kittler, and F. Porikli</i> Moderator: <i>E. R. Hancock</i>