

PhD in Information Technology and Electrical Engineering

Università degli Studi di Napoli Federico II

PhD Student: Giancarlo Sperli

XXX Cycle

Training and Research Activities Report – Second Year

Tutor: Antonio Picariello



Training and Research Activities Report – Second Year

PhD in Information Technology and Electrical Engineering – XXX Cycle

Giancarlo Sperli

Student

I graduated in Computer Engineering; currently, I am attending the second year of PhD in Information Technology and Electrical Engineering - ITEE- XXX Cycle at the University of Naples Federico II, under the supervision of Prof. Antonio Picariello. I was awarded a MIUR research grant.

Study Activities

Courses

Module	Type	Professor	Date	H	CFU
Network Security	Ad-Hoc	Simon Pietro Romano	I Semester	30	6

Seminars

Name	Type	Professor	Date	H	CFU
Test and Diagnosis of Integrated Circuits	Int	Alberto Bosio	17-18/11/2015	16	2,4
Hardware Security and Trust	Int	Giorgio Di Natale	19-20/11/2015	16	2,4
Predictable Real-Time Embedded Control Systems	Int	Giorgio Buttazzo	16/11/15	8	1,2

Credits year 1								Credits year 2								Credits year 3								Total	Check	
bimonth								bimonth								bimonth										
Estimated	1	2	3	4	5	6	Summary	Estimated	1	2	3	4	5	6	Summary	Estimated	1	2	3	4	5	6	Summary	Total	Check	
20(*)	0	5	3	7	0	0	15	15(**)	0	6	0	0	0	0	6	21							0	21	30-70	
8	1	1.5	3.8	5.2	0	0	11.5	6	6	0	0	0	0	0	6	12							0	17.5	10-30	
32	9	3.5	3.2	3	10	10	38.7	39	4	4	10	10	10	10	48	30							0	86.7	80-140	
60	10	10	10	15.2	10	10	65.2	45	10	10	10	10	10	10	60	63	0	0	0	0	0	0	0	0	125.2	180

(*) Waiting for perform final exam of "Semantic web reasoners: struttura, uso e ottimizzazioni"

(5 CFU) held by Prof. Bonatti

(**) Waiting for perform final exam of "Big Data Analytics and Business Intelligence "

(6 CFU) held by Prof. Picariello

Research Activities

In the last decade, the use of Online Social Networks (OSNs) has been rapidly growing allowing people, that lives in different places, to make friends and to share, comment and observe different types of multimedia content, producing a large amount of data showing Big Data features, mainly due to their high change rate, their large volume and intrinsic heterogeneity.

Social Network Analysis (SNA) methodologies have been recently introduced to study the properties of such kind of information networks with the aim of supporting a wide range of applications: information retrieval, influence analysis, recommendation, marketing, event recognition, user profiling, and so on.

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In our vision, an additional challenge in the management of OSNs derive from the presence of multimedia information and several questions arise, if we consider the important role that multimedia data can assume in a social network:

- Is it possible to exploit multimedia features and notion of similarity to discover more links? Are such links effectively useful for analytics?
- Can the different types of user annotations (e.g. tag, comment, keywords, status, etc.) and interactions with multimedia objects provide a further support for an advanced network analysis?
- Is it possible to integrate and efficiently manage in a unique network the information coming from OSNs and that are related to multimedia sharing systems (for example, a Facebook user has usually an account also on Instagram or Flickr)? How we can deal with a very large volume of data?
- In this context how is possible to model all the various relationships between users and multimedia objects? Are the graph-based strategies still the most suitable solutions?

The preliminary step to provide an answer for the above questions lies in the introduction of a model for Multimedia Social Networks (MSNs): integrated networks that combine the information on users belonging to one or more social communities, with all the multimedia contents that can be generated and used within the related environments.

In our vision, a MSN is basically composed by three different entities:

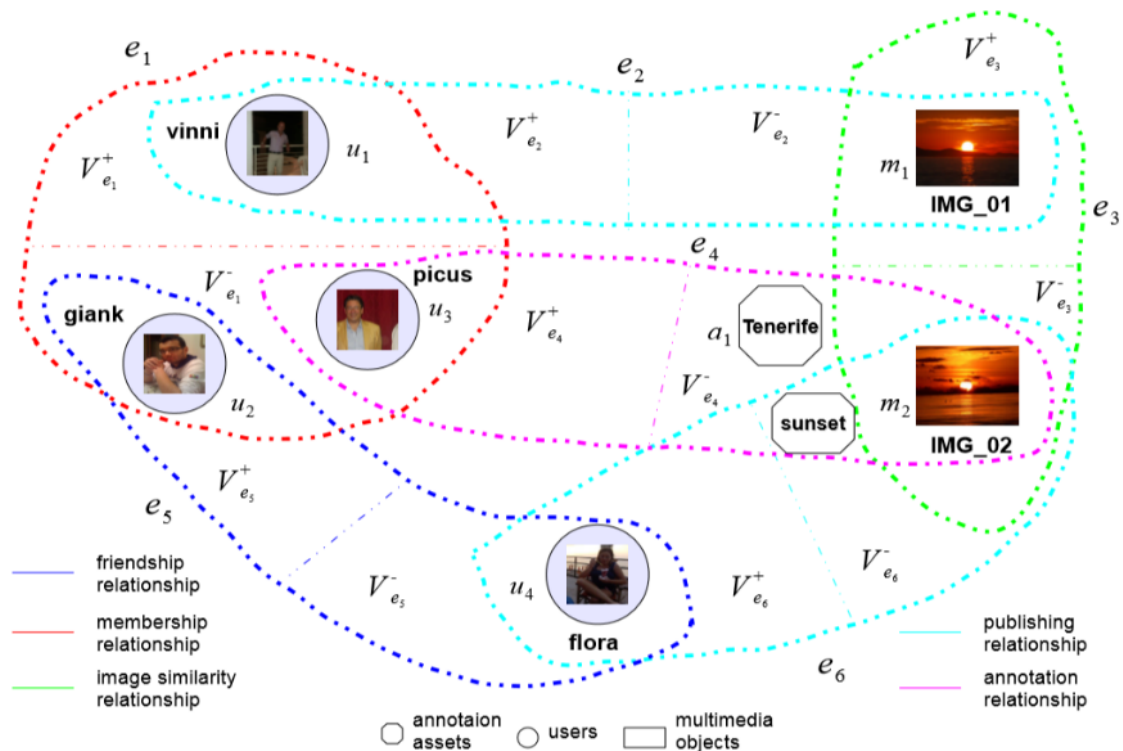
- **Users** - the set of persons and organizations constituting the particular social community. Several information concerning their profile, interests, preferences, etc. can be exploited by our model.
- **Multimedia Objects** - the set of multimedia resources (i.e. images, video, audio, etc.) that can be shared within a MSN community. High level (metadata) and low level information (features) can be properly used in our model.
- **Annotation Assets** - the most significant terms or named entities - whose definition can be retrieved from dictionaries, ontologies and so on - of a given domain, or topics, exploited by users to annotate multimedia data and derived from the analysis of textual information such as keywords, labels, tags, comments etc.

Analyzing the different types of relationships that can be established in the main social media networks, we have identified three categories:

- **User to User** relationships, describing user actions towards other users;
- **Similarity** relationships, describing a relatedness between two multimedia objects, users or annotation assets;
- **User to Multimedia** relationships, describing user actions on multimedia objects, eventually involving some annotation assets or other users.

Due to the variety and complexity of MSNs relationships, we decided to leverage the hypergraph formalism to model a MSN. In particular, our model relies on several concepts, Multimedia Social Network (seen as particular a weighted hypergraph) and social paths (i.e. hyperpaths). Actually, vertices and hyperedges are abstract data types with a set of properties (attributes and methods) that permit to support several applications.

The following figure shows an example of Multimedia Social Network.



We also introduce some user and multimedia ranking functions to enable different applications:

- User/Multimedia ranking function: that allows to rank a specific user or multimedia object respect to a user community.
- Topic User/Multimedia ranking function: that allows to rank a specific user or multimedia object respect to a user community and a particular topic.

In our model the concept of rank of a given node is related to the concept of influence, and in our vision it can be measured by the number of user nodes that are “reachable” within a certain number of steps using social paths.

Future Works

In order to perform an experimental evaluation of the proposed model, we are planning to exploit the introduced ranking functions to support different types of applications:

- Multimedia recommendation
- Influence analysis

Products

Conference proceedings:

- Amato, F., Moscato, V., Picariello, A., and Sperli, G. “Multimedia Social Network Modeling: A Proposal.” In *2016 IEEE Tenth International Conference on Semantic Computing (ICSC)* (pp. 448-453) (2016, February).. IEEE.

- Gargiulo Francesco, Flora Amato, Vincenzo Moscato, Antonio Picariello and Giancarlo Sperli “Nearest Query on Distributed Binary Trees Starting from a Random Node”, Knowledge Engineering and Semantic Web: 7th International Conference, KESW 2016, Prague, Czech Republic, September 21-23, 2016, Proceedings
- Amato, F., Moscato, V., Picariello, A., and Sperli, G. “Modelling Multimedia Social Network for Topic Ranking.” In *2016 30th International Conference on Advanced Information Networking and Applications Workshops (WAINA)* (pp. 81-86) (2016, March).. IEEE.
- Flora Amato, Vincenzo Moscato, Antonio Picariello and Giancarlo Sperli “*Recommender Systems and Social Networks: an application in Cultural Heritage*”, International Conference on Distributed Multimedia Systems (DMS16), Salerno, Italy
- Amato, F., Cozzolino, G., Di Martino, S., Mazzeo, A., Moscato, V., Picariello, A., Romano, S. & Sperli, G. (2016). Opinions Analysis in Social Networks for Cultural Heritage Applications. In *Intelligent Interactive Multimedia Systems and Services 2016* (pp. 577-586). Springer International Publishing.

Journal:

- Giancarlo Sperli, Flora Amato, Vincenzo Moscato, Antonio Picariello “Multimedia Social Network Modeling using Hypergraphs”, International Journal of Multimedia Data Engineering and Management (IJMDEM) volume 7 issue 3 pp. 53-77, (2016)
- Flora Amato, Vincenzo Moscato, Antonio Picariello and Giancarlo Sperli “Semantic Summarization of Web News” Encyclopedia with Semantic Computing (ESC), 2016

Tutorship

- **Big Data Analytics and Business Intelligence Course**
 - **Type:** Seminars
 - **Subject:** BI Software (Pentaho, SpagoBI), Hadoop, Pig Latin
 - **Hours:** 6
- **Sistemi Informativi Course**
 - **Type:** Seminars
 - **Subject:** BPMN
 - **Hours:** 4
- **Database Course**
 - **Type:** Seminars
 - **Subject:** Oracle architecture, Oracle 11g XE Suite, Oracle Application Express
 - **Hours:** 8

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