



Semistructured Temporal clinicAl geogRaphical Systems

Outline

- 1 The research group
- 2 Courses
- 3 Research
- 4 Theses

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Who we are



Carlo Combi

Full Professor

(Head of Computer
Science Department)



Alberto Belussi

Associate Professor



Barbara Oliboni

Assistant Professor



Roberto Posenato

Assistant Professor



Pietro Sala

Post-Doc



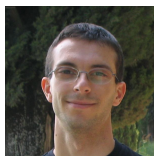
Mauro Gambini

PhD Student



Sara Migliorini

PhD Student



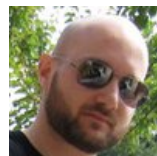
Gabriele Pozzani

Post-Doc



Elena Gaspari

Research Associate



Alberto Sabaini

PhD Student

What we do

The group focuses on the

- theoretical
- technological
- methodological

aspects of the information management in complex organizations. The research activities concern mainly problems that come from different contexts:

- information systems in medicine
- geographical information systems
- process-aware information systems
- information systems on the web
- temporal databases and spatial databases
- semistructured databases and workflows

Where we work

The STARS lab is located at the floor -2 in Ca' Vignal 2.

It's a lab where students collaborating with the group can develop their projects and theses.

The lab has 10 workspaces and includes 5 PCs equipped with Ubuntu and any software useful for the research and thesis work, e.g., PostgreSQL, MySQL, Java SDK, Pentaho, PostGIS.

The PCs in the lab are connected with the STARS server that manages the users' authentication and disk space.

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Provided courses

People in our research group give the following courses:

- in bachelor programs:
 - Degree in Computer Science (Laurea in informatica):
 - Databases
 - Degree in Bioinformatics (Laurea in bioinformatica):
 - Databases for Bioinformatics

Provided courses (cont.)

- in master programs:
 - Master Degree in Engineering and Computer Science:
 - Algorithms: complexity
 - Databases
 - Information systems
 - Geographic and multimedia information systems
 - Master Degree in Bioinformatics and Medical Biotechnologies
 - Biomedical and bioinformatics databases
 - Health information systems

Databases

Degree in Computer Science (Laurea in informatica)

Alberto Belussi

The class focuses on two main arguments:

- 1 Design of a database and its applications, including:
 - Conceptual and logical design of a database
 - Query languages: SQL and Relational Algebra
- 2 Design and implementation of data-intensive web applications, including:
 - Interaction with DBMSs
 - “MVC-2 Servlet centric” approach
 - Multimedia data in a DBMS

The course includes also lab practices about:

- Use of PostgreSQL
- Implementation of web applications based on Servlet and JSP

Databases for Bioinformatics

Degree in Bioinformatics (Laurea in bioinformatica)

Carlo Combi

The class focuses on:

- 1 Design of a database and its applications, including:
 - Conceptual and logical design of a database
 - Query languages: SQL and Relational Algebra
- 2 Design of data-intensive web applications, including:
 - Interaction with a DBMS
 - the MVC model
- 3 Management of bioinformatics information in databases:
 - XML for bioinformatics

The course includes also lab practices about:

- Use of PostgreSQL/PostBio
- Implementation of web applications based on Servlet

Complexity

Master Degree in Engineering and Computer Science

(Laurea magistrale in ingegneria e scienze informatiche)

Roberto Posenato

“Complexity” is one module of the “Algorithms” course.

The module introduces computational complexity theory, the NP-completeness theory, and computational analysis of problems w.r.t. their approximability:

- computational models
- time complexity
- space complexity
- reductions and completeness

Databases

Master Degree in Engineering and Computer Science
(Laurea magistrale in ingegneria e scienze informatiche)

Carlo Combi

The class focuses on:

- Functional dependencies, normal forms, decompositions
- Relational database normalization
- Relational calculus
- Object-relational databases: SQL-99
- XML: XML Schema, Xpath, Xquery

Information systems

Master Degree in Engineering and Computer Science
(Laurea magistrale in ingegneria e scienze informatiche)

Barbara Oliboni

The class focuses on the design and use of information systems within complex organizations:

- Structure and functions of an information system:
 - Economic, organizational, and management issues
 - Business process re-engineering
 - ERP, MRP, and CRM systems
- Decision support systems:
 - Data warehouse systems, OLAP and data mining techniques
- Designing cooperative information systems:
 - Workflow systems
 - Distributed databases

Multimedia and geographical information systems

Master Degree in Engineering and Computer Science

(Laurea magistrale in ingegneria e scienze informatiche)

Alberto Belussi

The course provides the concepts and methodologies for the design and implementation of spatial and multimedia databases:

- Object-oriented databases: ODMG, ODL, and OQL standards
- Multimedia databases: SQL-MM standard
- Conceptual modeling of a geographical database in GeoUML
- Geo-relational databases
- Mappings of a GeoUML conceptual schema onto geo-relational databases
- Query languages for geographical database: an extended version of the relational algebra

Biomedical and bioinformatics databases

Master Degree in Bioinformatics and Medical Biotechnologies

(Laurea magistrale in bioinformatica e biotecnologie mediche)

Barbara Oliboni

The class focuses on:

- Biomedical databases:
 - Design
 - Query languages for biomedical DBs
 - Examples: medical records and their querying
- Bioinformatics databases:
 - Management of semi-structured data
 - Techniques for information retrieval on semi-structured data
 - Querying of bioinformatics databases
 - XML and bioinformatics

Health Information systems

Master Degree in Bioinformatics and Medical Biotechnologies
(Laurea magistrale in bioinformatica e biotecnologie mediche)

Carlo Combi

The class focuses on:

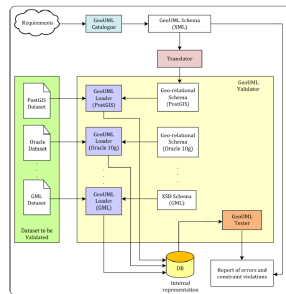
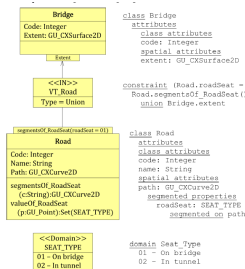
- temporal modeling, reasoning, and databases
- temporal reasoning and maintenance in medicine:
 - temporal clinical databases
 - abstraction of time-oriented clinical data
- time in clinical tasks:
 - time in clinical diagnosis
 - automated support to clinical guidelines and care plans
- the display of time-oriented clinical data and knowledge

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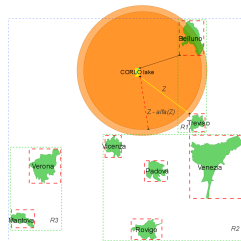
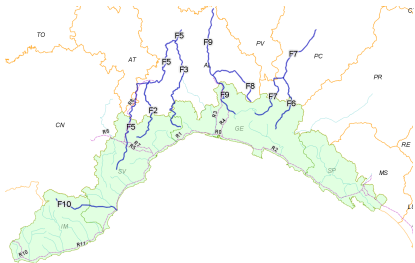
Spatial databases and applications in GIS (1/2)

- Conceptual design of geographical databases (A. Belussi): models for the conceptual design of geographical databases (GeoUML), comparison of GeoUML schemas
- Spatial integrity constraints (A. Belussi): languages for specifying spatial integrity constraints
- Validation of spatial data wrt conceptual schemas (A. Belussi): GeoUML tools (<http://spatialdbgroup.polimi.it/>)
- Methods for the updating of geographical databases maintaining topological properties (A. Belussi & S. Migliorini)



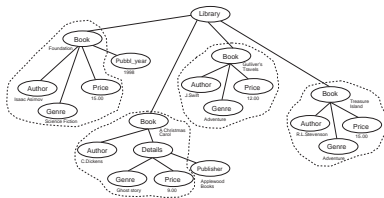
Spatial databases and applications in GIS (2/2)

- Approximate spatial queries: similarity functions for topological relations, approximate selection and join operators (A. Belussi)
- GeoProcess: Distributed long-running computation on spatial-related data that rely on loosely-coupled and interoperable services (S. Migliorini)
- Applicability of Scientific and Business Workflow Management Systems in the geographical context (S. Migliorini)
- Implementation of a modeling tool for geographical processes (S. Migliorini)



Temporal databases

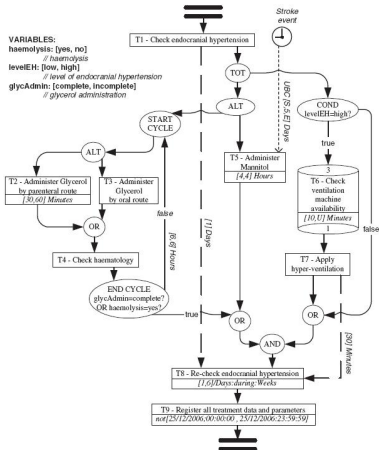
- Temporal functional dependencies (C. Combi)
- Dealing with clinical guidelines through workflow management systems (C. Combi)
- Temporal aspects of semistructured data (B. Oliboni): temporal data models and query languages, constraints for managing time dimensions
- Temporal aspects of XML data (B. Oliboni): evolution and versioning of XML documents and schemata



Workflows

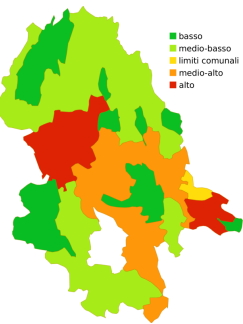
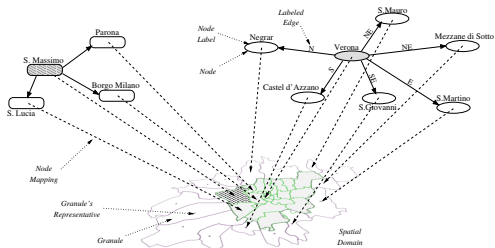
- Temporal Workflow Model Analysis (R. Posentato & C. Combi)
- Computational analysis of the controllability of Temporal Workflow Model schemata (R. Posentato & C. Combi)
- Logic in Computer Science: decidability, verification, synthesis (P. Sala)
- Formalization of existing process modeling languages for workflow (M. Gambini & S. Migliorini)
- Process modeling language design and implementation (M. Gambini)

- Process models verification and correction (M. Gambini)



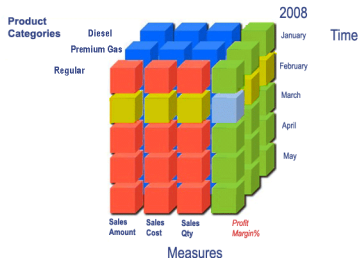
Data mining and Data warehousing

- (temporal) OLAP and data mining on biomedical/bioinformatics data warehouses (B. Oliboni & C. Combi)
- Temporal aspects of data warehouses (B. Oliboni & C. Combi)
- Spatio-temporal granularities (G. Pozzani)
- Querying of spatio-temporal databases (G. Pozzani)



XML and semistructured data

- XML and Data Warehouses: integration of XML documents in DW, ETL technologies for integrating XML documents in classic DWs (B. Oliboni)
- XML Data Warehouses: “OLAP-style” querying of native XML DBs and XML documents (B. Oliboni)
- XML and bioinformatics: representation and management of biological data in XML documents (B. Oliboni)
- XML and data mining: association rules for mining XML documents (B. Oliboni)



Advanced Web Application Framework Analysis

- Analysis of the most common frameworks w.r.t the data-centric development issues (R. Posenato & A. Belussi)
- Design patterns for data-centric web application development based on frameworks as Liferay (R. Posenato)
- Portlet technology (R. Posenato & A. Belussi)
- Mobile portlets (R. Posenato)



External projects and collaborations (I)

- XML and time. Versioning of XML Schemata: minimization of operation sequences for the schemata modification
 - B. Oliboni in collaboration with Giovanna Guerrini (University of Genova) and Marco Mesiti (University of Milan)
- XML and time: versioning and evolution of XML schemata
 - B. Oliboni in collaboration with Fabio Grandi (University of Bologna) and Zouhaier Brahmia (University of Sfax, Tunisia)
- Petri Nets Simulated Annealing (PNSA): a genetic algorithm to rectify Petri nets based process models
 - M. Gambini and S. Migliorini in collaboration with Queensland University of Technology (QUT), Brisbane (Australia)
- Comparative analysis of Scientific and Business Workflow Management Systems
 - M. Gambini and S. Migliorini in collaboration with Queensland University of Technology (QUT), Brisbane (Australia)
- Project IPPARCO: advanced solutions for computerized medical records
 - C. Combi and E. Gaspari in collaboration with Solinfo, S.r.l.

External projects and collaborations (II)

- Spatial (approximate) query processing and optimization
 - A. Belussi and S. Migliorini in collaboration with Prof.ssa B. Catania (University Of Genova)
- Conceptual modeling of spatial databases and GeoUML tools
 - A. Belussi and S. Migliorini in collaboration with Prof. G. Pelagatti (Politecnico di Milano)
- A GIS for the archeological site of Verona municipality
 - A. Belussi and S. Migliorini in collaboration with Prof. P. Basso and P. Grosso (University of Verona) and (Soprintendenza speciale per i beni archeologici di Roma).
- REVIVAL - REstauro dell'archivio Vicentini di Verona e sua accessibilità come Audio e-Library
 - B. Oliboni, G. Pozzani and F. Fontana in collaboration with Archivio Vicentini and Eye-Tech S.r.l.
- DataWarehouses, OLAP and Pharmacology
 - C. Combi, P. Sala, M. Gambini, A. Sabaini in collaboration with Prof. Ugo Moretti, Section of Pharmacology, Dept. of Public Health and Community Medicine, University of Verona

Publications statistics

Our research work has led to:

- 127 publications in international conferences
- 42 journal papers
- 18 book chapters
- 5 books
- 2 books/proceedings editing

Participation in conference committees

We participate in several international conference committees:

- Conference on Artificial Intelligence in Medicine (AIME)
- ACM International Conference on Information and Knowledge Management (CIKM)
- International Symposium on Temporal Representation and Reasoning (TIME)
- East-European Conference on Advances in Databases and Information Systems (ADBIS)
- International Workshop on Evolution and Change in Data Management (ECDM)
- International Conference and Workshop on Database and Expert Systems Applications (DEXA)
- Flexible Database and Information Systems Technology (FlexDBIST)
- European Symposium on Algorithm
- ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems (ACMGIS)

Participation in journal activities

We participate also in several journal activities:

- Information Systems
- Journal of Web Engineering and Technology
- Artificial Intelligence in Medicine
- Data and Knowledge Engineering
- International Journal of Knowledge and Learning
- Methods of Information in Medicine
- Annals of Mathematics and Artificial Intelligence
- ACM Transactions on Autonomous and Adaptive Systems
- IEEE Transactions on Neural Networks
- Geoinformatica
- International Journal of Geographical Information Science

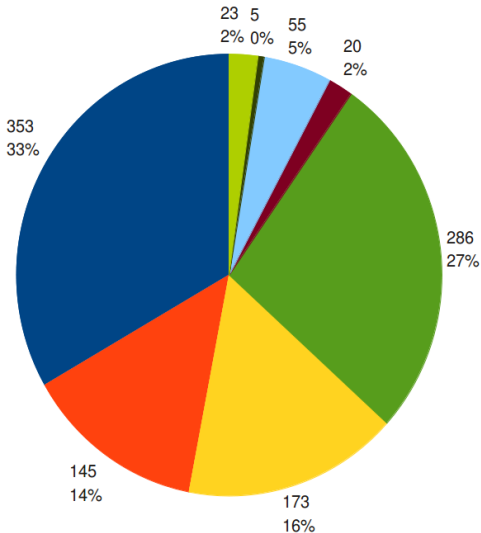
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Theses percentage: 2004 – Dic 2011

Percentuale tesi per area di ricerca

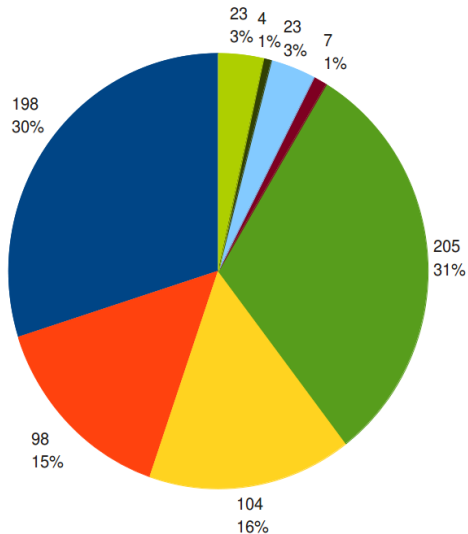
- Basi di dati
- VIPS
- Architetture e Sistemi
- Linguaggi, Logica e Metodi formali
- Modelli di calcolo
- AI e robotica
- Matematica
- Altri



Bachelor theses percentage: 2004 – Dic 2011

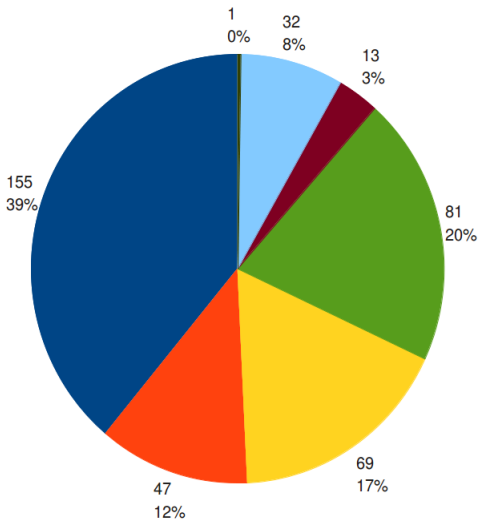
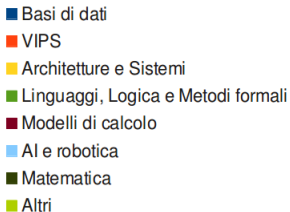
Percentuale tesi [Triennali] per area di ricerca

- Basi di dati
- VIPS
- Architetture e Sistemi
- Linguaggi, Logica e Metodi formali
- Modelli di calcolo
- AI e robotica
- Matematica
- Altri

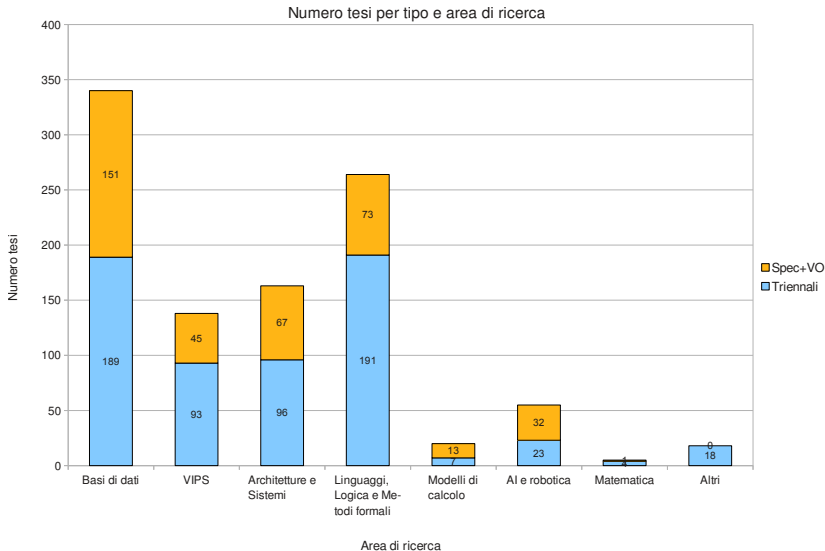


Master theses percentage: 2004 – Dic 2011

Percentuale tesi [VO+Spec] per area di ricerca



Theses distribution: 2004 – Dic 2011



Thesis proposals (I)

... and some internships

Alcune proposte di tesi e/o stage riguardano:

- (Triennali, Posenato) Tesi applicative sulla sperimentazione e personalizzazione del framework Liferay per la realizzazione di applicazioni web
- (Posenato) Tesi di analisi complessità computazionale di problemi di controllabilità nell'ambito di modelli di workflow temporali
- (Posenato) Tesi di studio e implementazione di algoritmi di controllabilità nell'ambito di modelli di workflow temporali
- (Combi) Analisi OLAP e data mining su dati (temporali) biomedici, nei seguenti ambiti
 - immunologia
 - psichiatria
 - farmacologia
 - emodialisi
 - genetica

Thesis proposals (II)

... and some internships

- (Combi) Modellazione e gestione di workflow temporali in medicina
 - gestione di linee guida
 - gestione di processi sanitari
- (Combi) Modelli computazionali per process-aware information systems
- (Combi) Petri Nets Simulated Annealing (PNSA): un algoritmo genetico per la correzione di modelli di processo basati su reti di Petri
- (Oliboni) Integrazione di XML e data warehouse
- (Oliboni) XML in bioinformatica
- (Oliboni) Aspetti temporali nella gestione di dati XML
- (Oliboni, Combi) Aspetti temporali nella gestione di dati semistrutturati
- (Oliboni, Combi) XML e data mining

Thesis proposals (III)

... and some internships

- (Triennali, Belussi) Strumenti innovativi per la progettazione e lo sviluppo di applicazioni web (Portlet, ...)
- (Triennali, Belussi) Progettazione concettuale di basi di dati geografiche: il modello GeoUML
 - analisi e confronto di specifiche
 - stesura di specifiche concettuali
 - confronto di specifiche con INSPIRE
- (Triennali, Belussi) Analisi di strumenti per la visualizzazione e gestione del dato geografico
- (Triennali, Belussi) Altri argomenti avanzati correlati alle basi di dati

Thesis proposals (IV)

... and some internships

- (Belussi) Confronto tra modelli concettuali per basi di dati geografiche
- (Belussi) Tecniche per il confronto di specifiche concettuali di basi di dati geografiche
- (Belussi) Studio e progettazione di strumenti per la visualizzazione di dati geografici guidati dallo schema concettuale
- (Belussi) Studio di tecniche guidate dallo schema concettuale per la migrazione di dati geografici da uno schema fisico all'altro
- (Belussi) Progetto di sistema informativo territoriale archeologico della città di Verona
- (Belussi) Tecniche per la gestione di interrogazioni spaziali approssimate: top-k, skyline basate sulle relazioni di similarità tra relazioni topologiche
- (Belussi, Combi) Supporto al geo-processing distribuito tramite tecnologie di workflow: workflow scientifici



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