

PROGRAMMA

ATTIVITA' FORMATIVA 2009

SCUOLA DI DOTTORATO IN INFORMATICA

Corsi Estesi 20/25 ore che verranno attivati nell'anno accademico 2008/2009

Area Tematica: Tecniche Evolute di Progettazione e Sviluppo del Software

Link di riferimento:

<http://homes.dico.unimi.it/~cazzola/phd-apt.html>

Paradigmi Evoluti di Sviluppo

Docente: Prof. Walter Cazzola

24 ore a partire dal mese di settembre

Il corso in questione avrà come oggetto uno dei più recenti approcci allo sviluppo del software: aspect-oriented programming e software development.

Aspect Oriented Programming e Software Development (4h)
definizione e proprietà

- approcci simmetrici e asimmetrici
- obliviousness e quantification
- progettazione orientata agli aspetti

Approccio Asimmetrico: il Caso AspectJ (6h)

- introduzione
- join point model
- reflection in AspectJ
- dynamic AOP in CaesarJ

Approccio Simmetrico: il Caso HyperJ (4h)

- introduzione
- join point model
- costruire applicazioni in HyperJ

Aspect-Oriented at Work (6h)

- aspect-oriented refactoring
- aspect-oriented design patterns

Limitazioni e Futuro della Ricerca (4h)

- dipendenza dalla sintassi
- annotazioni come una soluzione
- `@aspectj`
- il paradosso dell'aspect-oriented
- fragile pointcut problem
- intentional pointcut, blueprint, . . .

Riferimenti bibliografici

[1] Robert E. Filman, Tzilla Elrad, Siobhán Clarke, and Mehmet Ak, sit, editors. *Aspect-Oriented Software Development*. Addison-Wesley, Reading, MA, USA, 2004.

[2] Joseph D. Gradecki and Nicholas Lesiecki. *Mastering AspectJ: Aspect-Oriented Programming in Java*. John Wiley and Sons, March 2003.

[3] Ivar Jacobson and Pan-Wei Ng. *Aspect-Oriented Software Development with Use Cases*. Addison-Wesley, Reading, Ma, USA, December 2004.

Area Tematica: Logica Computazionale

Model-Checking a stati infiniti e procedure di decisione

Docente: Prof. Silvio Ghilardi, Ing. Ranise

25 ore dal 1/5/2009 al 25/5/2009 più 1 o 2 lezioni di laboratorio nel mese di giugno.

Il corso inquadrerà il model-checking come strumento totalmente automatico per la verifica delle proprietà dei sistemi reattivi e concorrenti, tentando al contempo una sintesi con le potenti tecniche emergenti nel settore delle procedure di decisione per la logica elementare, così come si stanno configurando all'interno della comunità che si occupa di S(atisfiability) M(odulo) T(theory). La scansione degli argomenti previsti è la seguente:

- successi e limiti del model-checking per sistemi a stati finiti;
- generalità sugli ordinamenti e sui w.q.o.: lemmi di Dikson, di Higman, teorema di Kruskal;
- i sistemi ben strutturati e l'algoritmo di 'backward reachability';
- prime applicazioni: i protocolli broadcast e i canali con perdita di informazione;
- ulteriori recenti sviluppi concernenti sistemi con 'topologie' più complesse e con dati locali presi da domini infiniti;
- il metodo di approssimazione e il modello con 'stopping failures';
- esempi di procedure di decisione nella logica elementare: l'aritmetica lineare reale e intera, la chiusura per congruenza, la soddisfacibilità di vincoli su liste e array;
- gli SMT solvers e l'integrazione dell'algoritmo DPLL con le procedure di decisione per la logica elementare;
- l'approccio dichiarativo al model-checking a stati infiniti tramite gli 'arraybased systems';
- panoramica su alcuni dei sistemi esistenti (PFS, ALV, BRAIN, ARMC, Babylon, ...).

Riferimenti bibliografici

- [1] P. A. Abdulla, K. Cerans, B. Jonsson, and Y.-K. Tsay. General decidability theorems for infinite state systems. In *LICS 1996*, pages 313–321, 1996.
- [2] P. A. Abdulla, G. Delzanno, and A. Rezine. Parameterized verification of infinite-state processes with global conditions (on efficient verification of parameterized systems). In Springer, editor, *CAV*, number 4590 in LNCS, pages 145-157, 2007.
- [3] P. A. Abdulla, N. B. Henda, G. Delzanno, and A. Rezine. Regular model checking without transducers. In Springer, editor, *TACAS*, number 4424 in LNCS, pages 721-736, 2007.
- [4] Aaron R. Bradley, Zohar Manna, and Henny B. Sipma. What's decidable about arrays? In *Proc. of the 7th Int. Conf. on Verification, Model Checking, and Abstract Interpretation (VMCAI 2006)*, volume 3855 of LNCS, pages 427–442. Springer-Verlag, 2006.
- [5] J. Esparza, A. Finkel, R. Mayr. On the verification of broadcast protocols. In *Proc. of LICS 1999*, pp. 352-359. IEEE Computer Society, 1999.
- [6] S. Ghilardi, E. Nicolini, S. Ranise, and D. Zucchelli. Towards SMT model checking of array-based systems. In *Proc. of IJCAR 2008*, LNAI. Springer, 2008. to appear.
- [7] Robert Nieuwenhuis, Albert Oliveras, and Cesare Tinelli. Solving SAT and SAT Modulo Theories: From an abstract Davis–Putnam–Logemann– Loveland procedure to DPLL(T). *Journal of the*

ACM, 53(6):937–977, 2006.

[8] T. Rybina and A. Voronkov. A logical reconstruction of reachability. In *Proc. of PSI*, pages 222–237. LNCS 2890, 2003.

[9] R. Sebastiani. Lazy satisfiability modulo theories. *Journal on Satisfiability, Boolean Modeling and Computation*, 3:141–224, 2007.

Orario

Giorni	Aula	Orario
04/05/2009	auletta 6 - Via Comelico	10:30 - 13:00 / 14:30 - 17:00
11/05/2009	auletta 6 - Via Comelico	10:30 - 13:00 / 14:30 - 17:00
18/05/2009	auletta 6 - Via Comelico	10:30 - 13:00 / 14:30 - 17:00
25/05/2009	auletta 6 - Via Comelico	10:30 - 13:00 / 14:30 - 17:00

più lezione/i a giugno per laboratorio finale
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Area Tematica: Modelli, Algoritmi e Complessità

Modelli e problemi con informazione parziale

Docente: Prof. Nicolò Cesa Bianchi

25 ore dal 17/4/2009 al 12/6/2009

Apprendimento supervisionato:

- Modello statistico
- Nearest neighbor
- Alberi di decisione
- Classificatori lineari e funzioni kernel
- Cenni al ranking

Apprendimento non supervisionato:

- Clustering
- Principal component analysis
- Independent component analysis
- Proiezioni casuali

Apprendimento con rinforzo

Riferimenti Bibliografici

L. Devroye, L. Györfi, G. Lugosi. A Probabilistic Theory of Pattern Recognition. Springer, 1996

C. Bishop. Pattern recognition and machine learning. Springer, 2006

Orario

Giorni	Aula	Orario
17/04/2009	auletta 6 - Via Comelico	10:30- 12:30
21/04/2009	auletta 6 - Via Comelico	13.30 - 15:30
24/04/2009	auletta 6 - Via Comelico	10:30- 12:30
28/04/2009	auletta 6 - Via Comelico	13.30 - 15:30
05/05/2009	auletta 6 - Via Comelico	13.30 - 15:30
08/05/2009	auletta 6 - Via Comelico	10:30- 12:30
12/05/2009	auletta 6 - Via Comelico	13.30 - 15:30
15/05/2009	auletta 6 - Via Comelico	10:30- 12:30
19/05/2009	auletta 6 - Via Comelico	13.30 - 15:30
22/05/2009	auletta 6 - Via Comelico	10:30- 12:30
26/05/2009	auletta 6 - Via Comelico	13.30 - 15:30
29/05/2009	auletta 6 - Via Comelico	10:30- 12:30
05/06/2009	auletta 6 - Via Comelico	10:30- 12:30
09/06/2009	auletta 6 - Via Comelico	13.30 - 15:30
12/06/2009	auletta 6 - Via Comelico	10:30- 12:30

Link di riferimento:

<http://homes.dsi.unimi.it/~cesabian/MPIP>

Modelli e problemi con informazione totale

Docente: Prof. Alberto Bertoni; Prof. Carlo Mereghetti

25 ore periodo ottobre/novembre 2009

Modelli di calcolo: deterministico, nondeterministico, probabilistico, alternante

Risorse: tempo, spazio

Simulazione tra modelli

Tesi del parallelismo

Classificazione dei problemi in classi di complessità, problemi completi

Applicazioni delle idee sviluppate:

- Ottimizzazione Combinatoria (NP-completezza)
- Comunicazione e Crittografia (funzioni “one-way”)
- Sicurezza (“zero-knowledge”)

Riferimenti Bibliografici

J. Hromkovic. Theoretical Computer Science. Springer, 2003

J. Hromkovic. Algorithmics for Hard Problems. Springer 2002

Area Tematica:

Process and Interactive Systems Design

Modelling processes, multimedia interaction and communities

Docente: Prof. Carlo Bellettini Prof. Ernesto Damiani, Prof.ssa Fiorella De Cindio, Prof. Goffredo Haus, Prof. Gabriele Gianini, Prof. Marco Mesiti, Prof. Piero Mussio, Prof. Paolo Perlasca,

25 ore periodo ottobre/dicembre 2009

Module 1: Business Process And Community Modeling

Goals:

to be able to design and monitor processes at different architectural levels, analyzing at the same time the corresponding community behavioral patterns.

Description:

Service-based compositions are being extensively studied in the software and services area. The module will present the basic results regarding service-based process design and monitoring at strategic, operational, and executive level by means of semantics-aware models and languages. Then, the module will discuss frameworks for managing and enforcing compliance policies on enterprise and business processes, and describe models for monitoring business process. It will also deal with support for integrating the descriptions and measurements of community events related to process activities and tasks. Then, it will focus on business process change enabled by social networking, as a potential driver for process productivity gains.

Program:

1. Models for process design: the MDA (Model Driven Architecture) approach
2. Business process monitoring: a metamodel-based approach
3. Expressing and Enforcing Policies on Business Process enactment
4. Social Computing Activities - Game theoretical models
5. Integrating Process and Community Monitoring

Module 2: Fondamenti di Computer-Mediated Communication

Programma

- Un modello di comunicazione digitale. i media digitali e le loro caratteristiche (segnale digitale, messaggio digitale, 5 livelli di astrazione. (fisico, sintattico, semantico, pragmatico, sociale', caratteristiche della comunicazione digitale)
- Interazione persona -macchina e persona-persona tramite media digitali
- l'evoluzione dell'utente da consumatore a produttore di strumenti e conoscenza.
- nuove dimensioni del software engineering

Module 3: Social Interactive Systems: Models and Design

Program:

- La Web Science: the empirical side of informatics
- Building 'social machines' (social interactive systems)
- Participatory Design: the history and the limits
- Toward an incremental approach to the design of social interactive systems

- Examples and Discussion

References:

J.Hendler, N. Shadbolt, W. Hall, T. Bernes-Lee, D. Weitzner, Web Science: An Interdisciplinary Approach to Understanding the Web, Comm. ACM, 51.7, July 2008.

P. Wegner, Interaction as a basis for empirical computer science, ACM Computing Surveys, 1995.

T. Winograd, F. Flores, Understanding Computers and Cognition: A New Foundation for Design. Norwood: Ablex Publishing, 1986.

Participatory Design

Nygaard, K. (1983). Participation in System Development. The Task Ahead. In U. Briefs, C. Ciborra, & L. Schneider (Eds.), *Systems design for, with and by the users*. North-Holland.

Kensing, F. & Blomberg, J. 1998. Participatory Design: Issues and Concerns In Computer Supported Cooperative Work, Vol. 7, pp. 167-185.

Schuler, D., & Namioka, A. (1993). *Participatory Design: Principles and Practices*, Hillsdale, NJ: Erlbaum.

Winograd, T. (1997). From computing machinery to interaction design. In P. Denning & R. Metcalfe (Eds.) *Beyond Calculation: the Next Fifty Years of Computing*. Amsterdam: Springer-Verlag, 146-162.

Social Interactive Systems Design

F. De Cindio, C. Peraboni, An Incremental Prototyping Approach for Social Interactive Systems, submitted.

Module 4: Formats and models for multimedia preservation, representation and advanced enjoyment

Programma

- Informazioni, dati, metadati, modelli. Rappresentazione digitale: dall'informazione ai dati.
- Acquisizione, elaborazione, generazione, interazione. Il formato IEEE 1599-2008.
- Conservazione digitale dell'informazione. Database musicali e multimediali. Il caso di studio del Teatro alla Scala.
- Architetture per la condivisione dell'informazione multimediale. L'Archivio Storico Ricordi e la Rete della Musica Italiana.

Riferimenti bibliografici

Goffredo Haus, Luca A. Ludovico, "The Digital Opera House: an Architecture for Multimedia Databases", *Journal of Cultural Heritage* 2006, vol. 7(2), pp. 92-97, 2006.

Denis Baggi, Adriano Baratè, Goffredo Haus, Luca A. Ludovico, "NINA - Navigating and Interacting with Notation and Audio", *Proceedings of the 2nd International Workshop on Semantic Media Adaptation and Personalization (SMAP 2007)*, pp. 134-139, London, Great Britain, 2007.

Adriano Baratè, Luca A. Ludovico, "Advanced Interfaces for Music Enjoyment", *Proceedings of the International Working Conference Advanced Visual Interfaces (AVI 2008)*, ACM Press, Napoli, Italy,

2008.

Luca A. Ludovico, "Key concepts of the IEEE 1599 Standard", *Proceedings of the IEEE CS Conference The Use of Symbols To Represent Music And Multimedia Objects*, IEEE CS, Lugano, Switzerland, 2008.

Module 5: Dataspaces: New Frontiers in Data Management

"A significant long-term goal for our community is to transition from managing traditional databases consisting of well-defined schemata for structured business data, to the much more challenging task of managing a rich collection of structured, semistructured and unstructured data, spread over many repositories in the enterprise and on the Web. This has sometimes been referred to as the challenge of managing dataspace". (Surajit Chaudhuri)

Dataspace involves issues related to the integration of widespread heterogeneous sources, schema matching, the location and understanding of data sources, adaptive query processing, data quality, sharing and combining data in a collaborative manner, profiling and personalization.

Purpose of this course is to present the concept of dataspace, survey the most relevant components behind dataspace, and discuss the current efforts in this field.

References:

Michael J. Franklin, Alon Y. Halevy, David Maier, From Databases to Dataspace: a new abstraction for data management. . SIGMOD Record, 34(4), 2005.

Alon Y. Halevy, Michael J. Franklin, David Maier. Principles of Dataspace Systems. In proceedings of PODS, 2006.

Shawn R. Jeffery, Michael J. Franklin, Alon Y. Halevy: Pay-as-you-go user feedback for dataspace systems. SIGMOD Conference 2008: 847-860

R. Lengu, P. Missier, A. Fernandes, G. Guerrini, M. Mesiti. Time-completeness trade-offs in record linkage using Adaptive Query Processing. EDBT Conference 2009.

G. Guerrini, M. Mesiti, I. Sanz. An Overview of Similarity Measures for Clustering XML Documents. Web Data Management Practices: Emerging Techniques and Technologies. IDEA GROUP. 2007.

Area Tematica:

Elaborazione dei Segnali Multi-dimensionali e Applicazioni

Fondamenti di elaborazione del segnale mono-dimensionale

Docente: Prof. Vincenzo Piuri, Prof. Roberto Sassi, Prof. Stefano Ferrari, Prof.ssa Rita Pizzi, Prof. Fabio Scotti

24 ore periodo ottobre/dicembre 2009

Programma:

- Richiami sui segnali a tempo continuo: definizione, classificazione, operazioni, valor medio, energia, potenza media, segnali sinusoidali, analogici. Fourier.
- Teoria dei segnali tempo-discreti: classificazione dei segnali numerici, le sequenze numeriche, operazioni elementari, energia e potenza media.
- I sistemi nel dominio del tempo discreto. Analisi delle sequenze nei domini del tempo e della frequenza.
- Il campionamento dei segnali. Il teorema del campionamento. Il campionamento dei segnali periodici. Il fenomeno della dispersione spettrale. Metodi per la riduzione degli errori dovuti alla dispersione spettrale.
- La convoluzione e la correlazione.
- Algoritmi e metodi per l'analisi spettrale di un segnale. Algoritmo di DFT. Algoritmo di FFT.
- I sistemi numerici lineari ed invarianti alla traslazione. Risposta al campione unitario. Stabilità e causalità. Sistemi descritti da un'equazione alle differenze.
- La trasformata z . Definizione e principali proprietà. Funzioni di trasferimento. Criteri di stabilità nel piano z . Diagrammi di poli e zeri e risposta in frequenza.
- Sistemi IIR e FIR. Analisi delle strutture di rete per la realizzazione di sistemi IIR e FIR. Rappresentazione in termini di grafo di flusso di segnali. Strutture in cascata e in parallelo. Strutture FIR a fase lineare.
- Codifica dei numeri con un numero finito di cifre. Sensibilità della posizione di poli e zeri alla quantizzazione dei coefficienti del filtro. Filtri IIR e filtri FIR.
- Ricampionamento: decimazione e interpolazione.

Area Tematica: Security, Privacy, and Data Protection

Fundamentals of security

Docente: Prof.ssa Pierangela Samarati

25 ore periodo ottobre/dicembre 2009

SYLLABUS

INTRODUCTION TO COMPUTER SECURITY.

Class introduction. An overview of computer security: secrecy, integrity, and availability. Attacks, threats, and vulnerabilities. Security services: authentication, access control, auditing, cryptography.

AUTHENTICATION. Identification and authentication. Authentication based on knowledge: passwords use and vulnerabilities, password management. Authentication based on possession: tokens use and vulnerabilities, smart tokens, RSA SecurID. Authentication based on user's characteristics: biometric authentication.

ACCESS CONTROL. Policies, models, mechanisms. Saltzer and Schroeder design principles. Classification of access control policies: DAC, MAC, and RBAC. Discretionary policies: access matrix, implementation of the access matrix (ACLs, capabilities, and authorization tables), take-grant model. DAC weaknesses: the Trojan Horse problem. Mandatory policies: security classifications and classification lattice. The Bell-LaPadula model. Limitation of MAC: covert and timing channels. Application of mandatory policies to databases: multilevel relational data model, polyinstantiation and its management, cover stories, MDBMS architecture. The Biba model: integrity policies, limitations. Role-based access control policies. Administrative policies: approaches to administration, authorization administration in SQL. Clark and Wilson model for integrity. Chines Wall. Expanding DAC authorizations: access control in object-oriented systems, abstractions, permissions and denials, conflict resolution policies, FAF rules. Examples of access control systems and languages: Oracle label security, *nix, Windows NT, Apache, Java.

SECURITY IN NETWORKS.

RECENT DIRECTIONS IN ACCESS CONTROL. Privacy-aware access control. Access control in open environments (attribute and credential-based access control). XACML.

Corsi Brevi 10/15 ore che verranno attivati nell'anno accademico 2008/2009

Area Tematica: Tecniche Evolute di Progettazione e Sviluppo del Software

Problematiche di Progettazione di Motori di Ricerca

Docenti: Prof. Paolo Boldi, Prof. Sebastiano Vigna

12 ore dal 3/6/2009 al 9/6/2009

- Struttura di motori di ricerca
- Crawler centralizzati e distribuiti
- Indicizzazione
- Querying e caching
- Spam e duplicati
- Copertura (via capture/recapture)

Riferimenti bibliografici

[1] Ricardo A. Baeza-Yates and Berthier Ribeiro-Neto. Modern Information Retrieval. Addison-Wesley Longman Publishing Co., Inc., Boston, MA, USA, 1999.

[2] Soumen Chakrabarti. Mining the Web: Discovering Knowledge from Hypertext Data. Morgan-Kauffman, 2002.

Orario

Giorni	Aula	Orario
03/06/2009	auletta 5 - Via Comelico	10:00 -12:00 / 14:30 -16:30
04/06/2009	auletta 6 - Via Comelico	10:00 - 12:00
05/06/2009	auletta 5 - Via Comelico	10:00 - 12:00
08/06/2009	auletta 5 - Via Comelico	14:30 – 16:30
09/06/2009	auletta 5 - Via Comelico	10:30 - 12:30

Implementation Techniques of AOP and Reflection

Docenti: Prof Shigeru Chiba

15 ore periodo ottobre/novembre 2009

This lecture presents implementation techniques for Aspect-Oriented Programming (AOP) and/or reflective languages. The reflection mechanism is one of the source of AOP. This lecture introduces the implementation of reflective languages as the basis of the implementation of early AOP languages.

Static AOP (4h)

- subclassing
 - interceptors, `java.lang.reflect.Proxy`
 - source-code/bytecode transformation
- caller-side transformation
– cflow implementation

Reflection (3h)

- 3-Lisp
- CLOS MOP
- Open C++
- `java.lang.reflect`

Dynamic AOP (4h)

- Hotswap
- Java class loader
- JVM-extensions, ...

Java bytecode (4h)

- JVM spec.
- code walker (BCEL v.s. ASM)
- Javassist

Riferimenti bibliografici

- [1] Shigeru Chiba. Load-Time Structural Reflection in Java. In Elisa Bertino, editor, Proceedings of the 14th European Conference on Object-Oriented Programming (ECOOP'2000), LNCS 1850, pages 313–336, Cannes, France, June 2000. Springer-Verlag.
- [2] Shigeru Chiba and Kiyoshi Nakagawa. Josh: An Open AspectJ-like Language. In Proceedings of the 3rd Int'l Conf. on Aspect-Oriented Software Development (AOSD'04), pages 102–112, Lancaster, UK, March 2004.
- [3] Ira R. Forman and Nate B. Forman. Java Reflection in Action. Manning Publications, October 2004.
- [4] Yoshiki Sato, Shigeru Chiba, and Michiaki Tatsubori. A Selective, Just-in-Time Aspect Weaver. In Proceedings of the 2nd Int'l Conf. on Generative Programming and Component Engineering (GPCE'03), LNCS 2830, pages 189–208, Erfurt, Germany, September 2003. Springer.

Area Tematica: Logica Computazionale

A unified view of uncertainty theories : Treating incompleteness and variability in knowledge representation and reasoning

Docenti: Prof. Didier Dubois Institut de Recherche en Informatique de Toulouse (IRIT) CNRS and Universite P. Sabatier

12 ore dal 20/4/2009 al 24/4/2009

Programma del corso:

- Incompleteness and gradualness.
- Conditionals and the limitations of probability.
- Plausible inference in the ordinal setting: The bridge between non-monotonic reasoning and possibility theory.
- Imprecise probability and belief functions.

Riferimenti bibliografici

[1] D. Dubois, H. Prade. Possibility theory. An approach to computerized processing of uncertainty, Plenum Press, New York, 1988

[2] D. Dubois, H. Prade. Fuzzy sets and systems. Theory and applications, Mathematics in Science and Engineering, 144. Academic Press, New York-London, 1980

Orario

Giorni	Aula	Orario
20/04/2009	Sala lauree - Via Comelico	14:30 - 17:30
21/04/2009	auletta 5 - Via Comelico	10:30 - 13:30
22/04/2009	auletta 5 - Via Comelico	9:30 - 12:30
24/04/2009	auletta 5 - Via Comelico	9:30 - 12:30

Residuated Structures: Algebraic and Logical Perspectives

Docenti: Prof. Constantine Tsinakis - Professor of Mathematics at Vanderbilt University

12 ore periodo settembre 2009

Programma del corso:

- Introduction to algebraic logic.
- Sequent (Gentzen-style) calculi versus axiomatic (Hilbert-style) calculi.
- Introduction to the algebraic theory of residuated lattices.
- Algebraizable logics and axiomatic extensions of the Full Lambek Calculus.

- Residuated lattices and the comparative study of sub-structural logics.

Riferimenti Bibliografici

[1] P. Jipsen, C. Tsinakis. A survey of residuated lattices, Ordered algebraic structures, pp. 19-56, Developments in Mathematics. vol. 7, Kluwer, Dordrecht, 2002

[2] N. Galatos, P. Jipsen, T. Kowalski, H. Ono, Residuated Lattices: An algebraic glimpse at substructural logics, Studies in Logic and the Foundations of Mathematics, vol. 151, Elsevier, Amsterdam, 2007

Area Tematica: Modelli, Algoritmi e Complessità

Algoritmi per problemi difficili (Algorithmics for Hard Problems)

Docenti: Prof. Juraj Hromkovic, Swiss Federal Institute of Technology (Svizzera)

12 ore 5-7 maggio 2009

Scopo del corso è la presentazione di metodi di attacco a problemi NP-hard. In generale, tali metodi sono basati sulla seguente strategia: ridurre i requisiti della soluzione o modificare leggermente la definizione del problema così da ottenere algoritmi di soluzione efficienti. Istanze di tale approccio sono

- algoritmi di approssimazione
- algoritmi randomizzati
- complessità parametrizzata

Orario

Giorni	Aula	Orario
05/05/2009	Sala riunioni 1° piano - Via Comelico	14:00 - 18:00
06/05/2009	Sala riunioni 1° piano - Via Comelico	14:00 - 18:00
07/05/2009	Sala riunioni 1° piano - Via Comelico	09:00 - 13:00

Cognitive Vision for Cognitive Systems

Docenti: Prof.ssa Barbara Caputo, Institut de recherche Idiap, Martigny, (Svizzera)

16 ore 9 – 30 novembre 2009

Objectives :

This course will provide the students with a unified view on techniques that enable the construction of vision algorithms for artificial cognitive systems. The course will discuss the specific requirements of vision for artificial intelligent systems and the impact of embodiment on the required visual capabilities, while introducing methods for categorization, attention, adaptive learning and spatial perception.

Content :

1. Computer vision vs cognitive vision. Basic concepts; perception-action loop; embodiment.
2. Categories and categorization. Object identification and classification; classes and categories; the importance of tasks on categorization; taxonomies; transfer of knowledge across hierarchical levels.
3. Learning and adaptation. Offline and online learning; detection of ignorance; memory growth and forgetting; long-term and short-term memory; one-shot learning of categories.

4. Attention. The relevance of task on attention; saliency maps; feature selection; top-down vs bottom-up models.
5. Laboratory exercises.
6. Final project.

Required prior knowledge :

Undergraduate-level knowledge in linear algebra (up to PCA), statistics (i.e. Gaussian distributions, central limit theorem) and image processing (i.e. Fourier analysis, image convolutions)

Note :

The course includes ex-cathedra lectures followed by laboratory exercises. The exercises will serve as starting points for the individual projects used for student examination (report and oral defense).

URL : <http://> (to be announced later)

Giorni	Aula	Orario
09/11/2009	Aula da destinarsi	10:30 - 12:30 15:30 - 17:30
16/11/2009	Aula da destinarsi	10:30 - 12:30 15:30 - 17:30
23/11/2009	Aula da destinarsi	10:30 - 12:30 15:30 - 17:30
30/11/2009	Aula da destinarsi	10:30 - 12:30 15:30 - 17:30

Area Tematica: Process and Interactive Systems Design

HCI: Exploring the outer limits

Docenti: Prof. Alan Dix (Computing Department, Lancaster University)

15 ore: 12-14 maggio 2009

In this course we will explore several areas that in different way explore the edges of HCI: emerging areas and aspects often ignored.

In particular we will be looking:

- physicality - the fact that the devices we use have a physical form and we ultimately interact with them physically
- bad things and bad ideas - considering some of the less pleasant issues of HCI, but also seeing how deliberately doing bad or silly things can lead to new insights
- appropriation and adoption - what happens **after** a product has been released and how this impinges back on our choices during design.

We will integrate these topics within group design exercises.

Looking at each in a little more detail:

Designing for Physicality

Although we live in an increasingly digital world, our bodies and minds are designed to interact with the physical. When designing purely physical artefacts we do not need to understand how their physicality makes them work - they simply have it. However, as we design hybrid physical/digital products, we must now understand what we lose or confuse by the added digitality. With two and half millennia of philosophical ponderings since Plato and Aristotle, several hundred years of modern science, and perhaps one hundred and fifty years of near modern engineering - surely we know sufficient about the physical for ordinary product design? While this may be true of the physical properties themselves, it is not the fact for the way people interact with and rely on those properties. It is only when the nature of physicality is perturbed by the unusual and, in particular the digital, that it becomes clear what is and is not central to our understanding of the world. We will discuss some of the obvious and not so obvious properties that make physical objects different from digital ones and attendees are invited to bring along physical objects and mechanical or digital devices to contribute to this discussion. We will also look at ways to model the physical aspects of devices and how these interact with digital functionality and, in a hands-on session, attendees will work in groups using semi-formal notations to describe with interaction with either a plain physical items (such as a pair of scissors), or a digital device (such as an MP3 player).

Breaking the Bounds: Abuse, Cruelty and Bad Ideas

Usability is about making things work well ... but what happens at the edges where this breaks down or is broken? We will explore these boundaries in user interface use, research and design. We will look at when people are abusive to computers is this cathartic, morally repugnant, bad taste or simply lacking in imagination? We will also look at how 'cruel design' deliberately broken interfaces can be used to understand unusual aspects of user interaction, rather like the victims of traumatic accidents have informed neurology. Finally, in a hands-on session attendees will find out for themselves how deliberately creating bad ideas can encourage innovation and reflection and even produce good ideas in the end.

Paths to Success: Designing for Adoption and Designing for Appropriation

Systems clearly need to be useful and usable on order to do a job for people and to do it easily. However if a system is wonderfully designed, fulfills a real need and would be a pleasure to use, it is still no good at all unless it is actually used. We will discuss two aspects of getting systems or products actually used: (1) adoption - managing the path from no users to widespread use; (2) appropriation - designing systems that users can change to their own purposes. This will draw on personal experience in (failed!) dot.com companies, analysis of other successful and unsuccessful products and more theoretical analysis. In a practical session attendees will attempt to design tomorrow's killer application or device!

Orario

Giorni	Aula	Orario
12/05/2009	Sala riunioni 1° piano - Via Comelico	09:00 - 12:30 14:30 - 17:30
13/05/2009	Sala Lauree 1° piano - Via Comelico	09:00 - 12:30 14:30 - 17:30
14/05/2009	Sala riunioni 1° piano - Via Comelico	09:30 - 12:30

Algebraic methods in musical informatics

Docenti: Prof. Moreno Andreatta IRCAM, Paris (Francia)

15 ore 18-20 maggio 2009

This course aims to provide a survey on some problems concerning the algebraic formalization of musical structures. After a short historical introduction to the emergence of the algebraic approach in 20th Century music and musicology, we will focus on some theoretical and computational aspects of algebraic models in music analysis and composition. In particular we will discuss the use of group actions in the problem of the enumeration and classification of musical structures as connected with set theoretical and transformational music analysis (including Lewin's GIS structures, Klumpenhouwer Networks, Tymoczko's musical orbifolds and some recent developments on Neo Riemannian analysis). As a counterpart of this paradigmatic approach, we will also discuss the use of the DFT (Discrete

Fourier Transform) to formalize maximal even sets and homometric relations between chords. This provides a new equivalent relation between musical structures for which the problem of finding an underlying group action still remains open. We then focus on the compositional problem of constructing rhythmic musical canons tiling the time axis. After presenting how composers utilized this theoretical model, we will discuss several algebraic constructions, including group factorizations, cyclotomic polynomial, Coven and Meyerowitz Conditions as well as some connections with mathematical conjectures (Minkowsky and Fuglede). We will alternate the theoretical presentation with some demonstrations showing how most of the mathematical aspects discussed in the course have been integrated in *OpenMusic*, a visual programming language for computer-aided music analysis and composition currently developed at Ircam.

Bibliography

M. Andreatta, Bibliografia online del corso “Elementi di Geometria Superiore 2: Matematica & Musica”, Dipartimento di Matematica, Università degli studi di Pisa, Anno Accademico 2008-2009: <http://recherche.ircam.fr/equipes/repmus/moreno/CorsoPisa08-09.html>

Orario

Giorni	Aula	Orario
18/05/2009	Sala riunioni 1° piano - Via Comelico	09:30 - 12:30 14:30 - 17:30
19/05/2009	Sala Lauree 1° piano - Via Comelico	09:30 - 12:30 14:30 - 17:30
20/05/2009	Sala riunioni 1° piano - Via Comelico	09:30 - 12:30

Area Tematica:
Elaborazione dei Segnali Multi-dimensionali e Applicazioni

Computational intelligence in prediction and control applications

Docenti: Prof. Piero Bonissone, GE Research, USA (corso in inglese)

12 ore periodo luglio 2009

Area Tematica:
Security, Privacy, and Data Protection

Computational intelligence techniques for cyber security

Docenti: Prof. Dipankar Dasgupta, University of Memphis, USA (corso in inglese)

12 ore periodo luglio/settembre 2009

Learning from data as an inverse problem

Docenti: Prof.ssa Vera Kurkova Institute of Computer Science - Academy of Sciences of the Czech Republic

8 ore dal 27/5/2009 al 4/6/2009

Presso la sede Consorziata dell'Università di Napoli "Pathenope" – Centro Direzionale – Isola 4 - Napoli

Generalization capability in learning from data can be investigated in terms of regularization, which has been used in many branches of applied mathematics to obtain stable solutions of inverse problems, i.e., problems of finding unknown causes (such as shapes of functions) of known consequences (such as measured data). It will be shown that supervised learning modeled in terms of minimizations of error functionals, the expected and the empirical one, can be reformulated as inverse problems with solutions in spaces of functions defined by kernels. Mathematical results from theory of inverse problems can be applied to construct optimal solutions of learning tasks, which can be used to design learning algorithms based on solutions of systems of linear equations.

Programma

- Learning from data and generalization
- Representation of learning as an inverse problem
- Learning algorithms based on the Representer Theorem
- Complexity of data with respect to a type of computational units

Orario

Giorni	Aula	Orario
27/05/2009	Aula 18 - CDN Isola C4	14:30 – 16:30
28/05/2009	Aula 18 - CDN Isola C4	10:30 - 12:30
03/06/2009	Aula 18 - CDN Isola C4	14:30 - 16:30
04/06/2009	Aula 18 - CDN Isola C4	14:30 – 16:30