[Title]			[Instructor]		
Advanced Interactive Systems Design			Masaki Omata / Yuichiro Kinoshita		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
323034	2	Computer Science and Media Engineering Embedded and Integrated System Development	Intensive	N/A	Japanese

[Outline and purpose]

This lecture discusses basic knowledge and methods for design, implementation, and evaluation of computer-based interactive systems in the context of everyday activities. Specifically, participants learn basic principles and methods for problem setting, understanding of human cognition, psychology and action, requirements analysis, design methods, and usability evaluation for designing systems to support human activities as has the current design norm shifted designers' focus from machine-centered design to human-centered design.

[Objectives]

1. To explain what good design is
2. To apply major guidelines and models to interface design
3. To employ methods to involve users in design processes
4. To implement applications based on various methods and systems
5. To apply methods to evaluate the quality of an interface
6. To acquire basic knowledge for applications and advanced studies

[Requirements]

Basic concepts on user interface, computer graphics, and software engineering

[Evaluation]

1. Assignments and reports: 70%
2. Workshop presentations: 30%

[Textbooks]

1. Rogers, Y., Sharp, H., Preece, J.: Interaction Design: Beyond Human - Computer Interaction, 3rd Edition, John Wiley & Sons, 2011 (ISBN: 9780470665763)

[References]

1. Buxton, B.: Sketching User Experiences: Getting the Design Right and the Right Design, Morgan Kaufmann, 2012 (ISBN: 9780123740373)
2. Carolyn Snyder (著), 黒須 正明 (監著): ペーパープロトタイピング: 最適なユーザインタフェースを効率よくデザインする, オーム社, 2004 (ISBN: 4274065669)
3. 大西 淳, 郷 健太郎: 要求工学, 共立出版, 2002 (ISBN: 4320027825)

[Schedule]

1. What is interaction design?
2. Understanding and conceptualizing interaction
3. Interaction paradigms
4. Data gathering
5. Process of interaction design
6. Design, prototyping and construction
7. Midterm workshop
8. Midterm presentation
9. Heuristic evaluation
10. Usability testing
11. Observational method and questionnaire method
12. Factorial design
13. Information behavior sensing
14. Final workshop
15. Final presentation

— Please note that this syllabus is subject to change.

[Title]			[Instructor]		
Advanced Software Engineering			Kentaro Go / Yoshimichi Watanabe		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
323121	2	Computer Science and Media Engineering Embedded and Integrated System Development Sustainable Society Studies	Intensive	N/A	Japanese

[Outline and purpose]

Recent software development has been moving its target domain from mission-critical information systems to solution design which realizes corporate value creation and improvement through the process of information systems development, operation, and maintenance. The movement requires us to integrate software development and management methodologies to plan, design, develop, operate, and maintain effective information systems. In this lecture, we discuss methodologies for information systems development focusing on efficiency and effectiveness in development. Specifically in the lecture, we explore methodologies for planning, requirements elicitation and analysis as well as operation and maintenance, project management, quality control, and documentation for effective information systems.

[Objectives]

To understand the following topics:
(1) planning of information systems
(2) fundamental concepts of requirements elicitation and analysis of information systems
(3) the overview of maintenance and operation of information systems
(4) techniques for project management in information systems development
(5) the importance of quality control in information systems development
(6) techniques for documentation in information systems development

[Requirements]

Fundamental knowledge on software engineering

[Evaluation]

Quizzes and reports: 100%

[Textbooks]

神長 裕明, 郷 健太郎, 杉浦 茂樹, 高橋 正和, 藤田 茂, 渡辺 喜道: ソフトウェア工学の基礎, 共立出版, 2012 年 (in Japanese).

[References]

ロジャー S. プレスマン: 実践ソフトウェアエンジニアリング, 日科技連出版社, 2005 年 (in Japanese).
小泉 寿男, 吉田 幸二, 辻 秀一, 中島 毅: ソフトウェア開発 (IT Text), オーム社, 2003 年 (in Japanese).

[Schedule]

(01) Introduction, overview and history
(02) Usability and user experience
(03) Service engineering
(04) Scenario and persona based design
(05) Fieldwork
(06) Idea generation
(07) Idea representation
(08) Prototyping
(09) Functional requirements and non-functional requirements (software quality)
(10) Formal specification and informal specification, requirements specification
(11) Software evolution (maintenance and operation)
(12) Quality management
(13) Project management
(14) Risk management
(15) Recent topics, concluding remarks

[Title]			[Instructor]		
Software Design and Verification Engineering			Masakazu Takahashi / Hidetomo Nabeshima		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
323123	2	Computer Science and Media Engineering	Intensive	N/A	Japanese

[Outline and purpose]

Nowadays, the troubles related computer systems occur, and those become social problems. Those causes are considered as followings: (1) developed software does not necessarily satisfy the requirement specification, (2) errors are included in the developed software. In this lecture, we aim to learn the validation method for checking the consistency between requirements and software and the verification method for checking the existence of errors. We aim to be able to develop the software that corresponds to the requirements and has high reliability through those methods.

[Objectives]

1. To understand software design documents.
2. To develop software that meets software specifications
3. To develop test specifications and implement them

[Requirements]

1. Grounding in software engineering
2. Programming skill (C, C++, or Java)

[Evaluation]

[Verification]: Homework 100%
[Design]:

[Textbooks]

N/A

[References]

[Verification]
Glenford J. Myers, The Art of Software Testing Second Edition, Word Association (2006).
Glenford J. Myers, Reliable Software Through Composite Design, Mason/Charter Publishers(1975)
[Design]
Tom DeMarco, Structured Analysis and System Specification, Yourdon Inc.(1979)
岡田敦彦，山田隆太，Java，オブジェクト指向の壁を突破する抽象化プログラミング入門，技術評論社(2007)(in Japanese)

[Schedule]

(01) The relationships between software design and verification: Introduction, V-Chart
(02) Case Study: Computerized System Validation
(03) Verification: Black Box Testing(1), Instruction Coverage Test, Decision Coverage
(04) Verification: Black Box Testing(2) Branch Coverage, Condition Coverage, Decision/Condition Coverage
(05) Verification: White Box Testing(1), Test Coverage, Equivalence Partitioning
(06) Verification: White Box Testing(2), Limit Value Analysis, Cause-Effect Graph
(07) Verification: Unit Test, Integration Test, System Test, Operations Test, Regression Test
(08) Design: Structured Analysis and design, DFD, DCD, Data Dictionary, Structure Chart
(09) Design: Object Oriented Analysis and design: Use-Case, Class Diagram, Object Diagram, Sequence Diagram, State Machine Diagram
(10) Design: Traceability between design specifications
(11) Design: Traceability between test specifications
(12) Requirement Specification, Preliminary Design Specification, Detailed Design Specification
(13) Design: Structured Programming
(14) Design: Object Oriented Programming
(15) Summary

[Title]			[Instructor]		
Parallel Distributed Systems			Hidetoshi Mino / Tomohiro Suzuki		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
323131	2	Computer Science and Media Engineering	Intensive	N/A	Japanese

[Outline and purpose]

In this class students learn basic concepts in parallel processing and practice in parallel programming and optimizations. They also learn how to build robust networks and server systems through hands-on labs.

[Objectives]

・To learn typical issues and their solutions in parallel processing.
・To acquire basic skills in parallel programming and optimizations.
・To learn design principles of high availability systems and their construction.

[Requirements]

Students are required to know basic concepts in computer networks, the internet, operating systems and computer programming.

[Evaluation]

Students will be assessed through reports on the class objectives. They are also expected to demonstrate their ability through lab activities.

[Textbooks]

Online materials and hand-outs will be provided.

[References]

[Schedule]

1. Redundancies in the Layer 2 Networks
2. Redundancies in the Layer 3 Networks
3. Failover and Load-balancing
4. RAID
5. Storage Area Networks
6. Distributed File Systems
7. High Availability Cluster Systems
8. Assessment
9. Introduction for Parallel Computing
10. Optimizing Matrix-Matrix Multiplication
11. Parallel programming with OpenMP
12. Parallel programming with MPI (1)
13. Parallel programming with MPI (2)
14. GPU Computing (1)
15. GPU Computing (2)

[Title]			[Instructor]		
Semantic Multimedia Processing			Ryutarou Ohbuchi		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
323211	2	Computer Science and Media Engineering	Intensive	N/A	English／Japanese

[Outline and purpose]

Visual data objects having multiple data types, namely, image, movie and 3D shape model, have been accumulated in-house and on the Internet. Consequently, content-based, "semantic" processing of those multimedia data, including comparison, recognition, retrieval, and summarization, has become all the more important.

This course provides an overview of approaches and algorithms for content-based, semantic processing of multimedia data. This course focuses on content based matching, recognition, and retrieval of image data. Algorithms to extract and compare image features are presented, followed by several machine learning based approach to bridge the gap between low-level features and "meaning" and "context" of the media.

[Objectives]

* Understanding method to analyze, compare, cluster, retrieve, or recognize image and other multi-media data.
* To know methods to extract numerical features from image and movie data. Examples include edge detection, interest point detection, local image description and aggregation.
* Method to compare extracted features for comparing, ranking, recognizing, or parsing images.
* Machine learning techniques such as clustering, dimensionality reduction, and classifier necessary for semantic media processing.

[Requirements]

Programming skill in C either C or C++ is a must, as homework involves programming in one of these programming languages. If your prefer languages other than C or C++, instructor's permission is required.
Students are advised, but not required, to know basics one or more of following subjects; linear algebra, signal processing, image processing, 3D computer graphics, information retrieval, and machine learning.

[Evaluation]

Students are evaluated primarily based on homework that involves programming

[Textbooks]

[References]

Will be specified by the instructors during the course.

[Schedule]

1. Inside multimedia data
2. Object, camera model, OpenCV
3. Filtering, frequency domain representation
4. Template matching, image pyramid, filter-bank
5. Edge detection, interest point
6. Harris corner detector, DoG scale space, SIFT feature
7. Object detection, Bag-of-features aggregation
8. Announcing course project, machine learning
9. Large scale image retrieval
10. Spatial verification, RANSAC
11. Machine learning, classifier, kNN classifier
12. SVM, Randomized tree and forest
13. Linear and non-linear dimensionality reduction
14. Querying with intention: relevance feedback,
15. Deep learning, Summary

[Title]			[Instructor]		
Internet Engineering			Hidetoshi Mino /Atsushi Kara		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
GTK504	2	Computer Science and Engineering Computer Science and Media Engineering Embedded and Integrated System Development	1st Semester	Tue.／V	

[Outline and purpose]

This course aims at studying the Internet as a transmission medium, focusing on the transport and network layers.

[Objectives]

The main topics consist of the congestion avoidance mechanism of TCP, IP addressing and routing principles, configuring routers, IP security and VPN.

[Requirements]

Basic knowledge of TCP/IP

[Evaluation]

Thorough understanding of the course topics: 50%
Active involvement in the class: 50%

[Textbooks]

Hand-out

[References]

[Schedule]

1. Introduction
2. Basis of TCP (Header structure 1)
3. Basis of TCP (Header structure 2, MTU/MSS)
4. Basis of TCP (Stating and closing connections 1)
5. Basis of TCP (Starting and closing connections 2)
6. Congestion control of TCP (Delayed Ack, Nagle Algorithm, Window control, Slow Start)
7. Congestion control of TCP (Congestion Avoidance, Fast Retransmit, Fast Recovery)
8. Improving performance of TCP (Path MTU Discovery, Window Scale Option)
9. Basis of IP (Address structure, Netmask, Default Gateway)
10. Basis of IP (CIDR, Subnetting, Address aggregation)
11. Dynamic Routing Protocol (Principle of RIP1/RIP2)
12. Dynamic Routing Protocol (RIP1/RIP2, Split Horizon, Poisoned Reverse, RIP-MD5)
13. IP Security (IPsec)
14. IP Security (ISAKMP and IKE)
15. Summary

See the following Web page:
http://www.u-aizu.ac.jp/~kara/
for the course schedule updates and hand-out material.

[Title]			[Instructor]		
Information Media Processing of Human Sensation			Kenji Ozawa / Masayuki Morisawa		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
323241	2	Computer Science and Media Engineering	Intensive	N/A	Japanese

[Outline and purpose]

This course will give a lecture on the media processing relating to the five senses: vision, hearing, touch, taste, and smell. First, you will learn the basis of semiconductor engineering, physics, and electrochemistry which are required for understanding a sensor occupying an important place in the human sensing mechanism and the sensory information media. Next, you will study the mechanism to replicate those senses artificially from the aspect of a sensor. In the last half, the lecture will focus on audio media which occupy an important role in the today's media engineering along with visual media. Firstly, you will learn the physical basis with regard to sound and its origin, vibration. Secondly, you will study electro-acoustic conversion, which is necessary to record and transmit acoustical information. Finally, with respect to phonetic information and acoustical information, the lecture will deal with a signal processing which is used in familiar media.

[Objectives]

7. To master the rudimentary knowledge which is required for understanding a sensor occupying an important place in the sensory information media
8. To understand the basis of sensors
9. To master the basis of speech information processing after understanding the basic nature of sound

[Requirements]

Knowledge level of physics in basic engineering department subjects

[Evaluation]

Two reports (80%) and mini exams for evaluation (20%)

[Textbooks]

[References]

日本音響学会 編，城戸健一 曽根敏夫，柴山乾夫，山口公典，中鉢憲賢 著：基礎音響工学，コロナ社, 1990 年（in Japanese)
日本音響学会 編，鈴木陽一，赤木正人，伊藤彰則，佐藤洋，苣木禎史，中村健太郎 著：音響学入門，コロナ社，2011 年（in Japanese)

[Schedule]

1. The basis of sensors and the human sensing mechanism
2. The basis of semiconductor engineering
3. The basis of semiconductor sensors
4. Optical sensors, pressure sensors, temperature sensors, magnetic sensors
5. Visual sensor
6. Chemical sensors and biosensors
7. Taste sensor
8. Physical fundamentals of sound
9. Physical fundamentals of vibration
10. Electro-acoustic transducer (Loudspeaker)
11. Audio sensor (Microphone)
12. Speech and its coder
13. Acoustical signal processing (Part I)
14. Acoustical signal processing (Part II)
15. Summary

[Title]			[Instructor]		
Image Media Processing			Xiaoyang Mao / Hidetoshi Ando		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
323251	2	Computer Science and Media Engineering Embedded and Integrated System Development	Intensive	N/A	English／Japanese

[Outline and purpose]

Image media processing consists of two major topics, extraction of information from images using image processing and recognition, and generation of images from various description data using computer graphics techniques. The course focuses mainly on image generation techniques, covering basic and recent topics of texture image generation and GPU programming.

[Objectives]

Image media are widely used in digital televisions, cameras, copy machines, cars, airplanes, mobile phones, game devices and in the internet. Students will learn recent image media processing and programming techniques which are essential for ubiquitous computing track and intelligent media computing track.

[Requirements]

Knowledge about basic algorithms of computer graphics and image processing.

[Evaluation]

Students will be asked to write reports on research topics related to image media processing.

[Textbooks]

None

[References]

Recently published research papers which will be specified by the instructors during the course.

[Schedule]

1.Introduction
2.Texture and texture generation
3.Texture generation from examples(1)
4.Texture generation from examples(2)
5.Procedural texture generation(1)
6.Procedural texture generation(2)
7.Procedural texture generation(3)
8.Implementation of texture generation
9.Real-time CG techniques using GPU
10.Shader programming(1)
11.Shader programming(2)
12.Shader programming(3)
13.Shader programming(4)
14.Shader programming(5)
15.Summary

[Title]			[Instructor]		
Artificial Intelligence			Motonobu Hattori / Koji Iwanuma		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
323321	2	Computer Science and Media Engineering	Intensive	N/A	Japanese

[Outline and purpose]

As the Internet and the Web spread, we experience a flood of information. Consequently, there is a growing demand for advanced computing techniques which handle information much more effectively and carry out intelligent works for us. The purpose of this course is to give students an understanding of Artificial Intelligence methodologies. In the first half of this course, the basics of transaction/sequential data mining and some advanced topics for the Web intelligence are introduced. The second half of the course introduces neuro-computing as another intelligent computing technique for symbol processing based AI. The basics of neuro-computing and its applications to pattern recognition and data mining are presented.

[Objectives]

10. To understand the basics of data mining techniques for discrete data
11. To understand examples of the web intelligence
12. To understand the basics of neuro-computing
13. To understand some practical applications of neuro-computing

[Requirements]

A grounding of linear algebra, analytics, discrete mathematics, Boolean algebra, algorithms and data structure, information theory, and database

[Evaluation]

Homework: 100%

[Textbooks]

[References]

1. J. Han and M. Kamber, Data Mining – Concepts and Technique – Second Edition, Morgan Kaufmann Pub. (ISBN:1558609016)
2. P. Tan, M. Steinbach and V. Kumar, Introduction to Data Mining, Adison-Wesley (ISBN:0321464494)
3. 吉冨康成，ニューラルネットワーク，朝倉書店(ISBN:4254116128) (in Japanese)

[Schedule]

1. Data-mining: basic concepts of association analysis for transaction databases
2. Data-mining: advanced association analysis with various forms of compression
3. Data-mining: evaluation of association patterns
4. Data-mining: basic concepts of sequential data mining
5. Data-mining: online sequential data mining
6. Web intelligence: example-based transformation from HTML to XML
7. Web intelligence: semi-automatic construction of domain-specific Web search engines
8. Neuro-computing: computational model of the brain
9. Neuro-computing: neural network models
10. Neuro-computing: feedforward neural network
11. Neuro-computing: mutually connected neural network 1
12. Neuro-computing: mutually connected neural network 2
13. Neuro-computing: competitive learning neural network
14. Neuro-computing: applications to data mining
15. Summary

[Title]			[Instructor]		
Advanced Natural Language Processing			Fumiyo Fukumoto / Yoshimi Suzuki		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
323451	2	Computer Science and Media Engineering	Intensive	N/A	English／Japanese

[Outline and purpose]

Language is fundamental to establish a mutual understanding between people, and it is closely related with intelligent activities such as cognition, reasoning and learning. The purpose of this course is to understand linguistic phenomena and computational model of language. The course consists of two parts. The first part addresses the issue of linguistic phenomena, and gives computational model of language and foundations of statistical natural language processing. The second part gives introductory material on applications of natural language processing. It covers the current state-of-the-art techniques for each application, *i.e.*, information retrieval, text classification, text summarization and information filtering.

[Objectives]

1. to understand linguistic phenomena and computational model of language
2. to understand fundamental technique of intelligent natural language processing

[Requirements]

Finite automaton, information theory, statistics and probability theory, and algorithms for programming language

[Evaluation]

Midterm examination : 50%
Final examination : 50%

[Textbooks]

None

[References]

C. D. Manning and H. Schutze : Foundations of Statistical Natural Language Processing, The MIT PRESS, 1999.

[Schedule]

1. Statistical Natural Language Processing
2. Natural Language Analysis 1: Morphological analysis
3. Natural Language Analysis 2: Syntactic analysis
4. Dictionaries and Corpora
5. Natural Language Learning 1: Lexical knowledge acquisition from corpora
6. Natural Language Learning 2: Bilingual words acquisition from corpora
7. Natural Language Learning 3: Syntactic grammar acquisition from corpora
8. Information Retrieval 1: Overview of the IR
9. Information Retrieval 2: Evaluation of the IR
10. Full-text search algorithm 1: Full-text search by sequence matching
11. Full-text search algorithm 2: Full-text search by indexing
12. Text Classification
13. Text Summarization
14. Information Filtering
15. Summary

[Title]			[Instructor]		
Special Lecture on Advanced Topics in Enterprise Computing I			Masakazu Takahashi		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
323360	1	Computer Science and Media Engineering	Intensive	N/A	Japanese

[Outline and purpose]

This course will give a lecture on the Structured Analysis Method. Structured Analysis is a classic method for software development. But it is used for developing software in these days because of its ease of use. At first, you will learn the basis of Structured Method. At second you will design software using Structured Analysis. And at last you will present the result of design and discuss it with participants.

[Objectives]

[01] To read software specification written in Structured Design Method in Real-Time
[02] To develop software specification using Structured Design Method in Real-Time

[Requirements]

[01] Grounding in software engineering

[Evaluation]

[01] Homework & Presentation 80%
[02] Mini examination 20%

[Textbooks]

N/A

[References]

[01] Tom DeMarco, Structured Analysis and System Specification, Yourdon Press(1979)
[02] Page M. Jones, The practical guide to structured systems design(2nd Edition), Yourdon Press(1988)

[Schedule]

[01] Data Flow Diagram
[02] Data Context Diagram
[03] Process Specification
[04] Data Dictionary
[05] Requirement Analysis and Software Design – (1)
[06] Requirement Analysis and Software Design – (2)
[07] Summary

[Title]			[Instructor]		
Special Lecture on Advanced Topics in Enterprise Computing II			Masakazu Takahashi		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
323361	1	Computer Science and Media Engineering	Intensive	N/A	Japanese

[Outline and purpose]

This course will give a lecture on the Structured Analysis Method in Real-Time. Structured Analysis in Real-Time is a classic method for software development Real-Time . At first you will learn the basis of Structured Analysis Method in Real-Time. At second you will design Real-Time software using Structured Analysis in Real-Time. And at last you will present the design result and discuss it with participants.

[Objectives]

[01] To read software specification written in Structured Design Method
[02] To develop software specification using Structured Design Method

[Requirements]

[01] Grounding in software engineering
[02] Grounding in Structured Analysis

[Evaluation]

[01] Homework & Presentation 80%
[02] Mini examination 20%

[Textbooks]

N/A

[References]

[01] D. J. Hatley and I. A. Pribhai, Strategies for Real-Time System Specification, Droset House (1988)
[02] SESSAME WG2, 組込みソフトウェア開発のための構造化モデリング, 翔泳社 (2006) (in Japanese)

[Schedule]

[01] Sequential system and Combination System
[02] Decision Table and Activation Table
[03] State Transition Diagram
[04] Control Flow Diagram
[05] Control Context Diagram
[06] Requirement Analysis and Software Design in Real-Time System – (1)
[07] Requirement Analysis and Software Design in Real-Time System – (2)
[08] Summary