

*Request for a New Graduate Certificate Program*  
Department of Computer and Information Science  
School of Science, IUPUI

**Database and Datamining Certificate**

*To be offered as a Purdue Certificate at IUPUI*  
May 30, 2005

**Purpose of the Program**

IUPUI's mission is to serve Indiana by providing the best possible educational experience for the population and the greatest possible growth in knowledge resources in support of the state's business, industrial and governmental activities. In this effort, it is striving to be the exemplary "Urban University."

In support of the university's mission, the department's mission is to build excellent academic programs coupled with strong research programs, industrial collaborations and community relationships. The three pillars supporting this mission are its Graduate, Undergraduate and Service Course Programs. The dynamics of Indiana, particularly in the Indianapolis area, obligate the department to not only continue, but increase this effort. The department has a key role to play in satisfying the information technology needs of the surrounding community and guiding their development.

In order to increase the Graduate Program's ability to support the department's mission, the department proposes to broaden and enrich its curriculum in anticipation of the rapidly growing trends in information technology, particularly as it is manifesting itself in the Indianapolis area. The objective of the proposed Graduate Certificate Program in Databases/Datamining is to develop in the student skills and knowledge of the computer science fundamentals and an ability to apply these to practical problems as it relates to Databases/Datamining. Another objective of this program is to provide an integrative experience by applying to a complex problem of a practical nature the theory and skills learned in the course work. The graduate of this program is prepared to adapt and respond quickly to the employer's specialized requirements.

This program will introduce students to the core concepts necessary for the design, implementation, and application of database systems. It stresses the fundamental principles in database modeling and design. The aim is to address the continuing need for engineering databases for complex and ever changing applications requiring security, performance, and reliability. The teaching approach will be both instructional and researching. The program emphasizes fundamentals for the logical design of database systems, the entity-relationship model, semantic model, hierarchical model, network model implementations of the models, design theory for relational database, design of query languages and the use of semantics for query optimization, design and verification of integrity assertions and security, and introduction to intelligent query processing and database machines.

*Data Mining* is an analytic process designed to explore data (usually large amounts of data stored in a database - typically business or market related) in search of consistent patterns and/or systematic relationships between variables, and then to validate the findings by applying the detected patterns to new subsets of data. The ultimate goal of data mining is prediction - and predictive data mining is the most common type of data mining and one that has the most direct business applications. Through this program, students will have the understanding of initial data exploration methods, model building or pattern identification with validation/verification, and deployment (i.e., the application of the model to new data in order to generate predictions). Numerous datamining algorithms and tools will be introduced as well.

**Relation to existing certificate programs**

This program has no relation to existing certificate programs. However, the program is a complement to our existing undergraduate and M.S. programs.

**The target audience**

The location of the IUPUI campus is unique within the state and the need for targeted computer science certificate programs is unique to the population and companies within the metropolitan area. Our current research activities involves local community affiliation and collaboration. The community includes the local industries such as Eli Lilly & Co., Raytheon, and the IU Medical School. All of these entities in the local community have application domains which have the need for high quality fundamental research. This program will allow employees of these local industries to establish collaborations with our research faculty while at the same time providing them with the skills necessary to introduce these initiatives within their companies.

**Plan for sustaining steady-state enrollment**

In the first year (Fall 2005), five students will likely participate in the program. It is anticipated that this number will rise rapidly to ten per year in the next two to three years, as the awareness of the program increases. The potential exists for much greater growth beyond this subsequently.

**New resources**

No new resources are needed. All courses are currently taught at IUPUI by existing faculty.

**Proposed date of the initiation of the certificate program**

Proposed date of implementation is Fall 2005, assuming all necessary approvals have been met.

**Persons designated as the certificate program head**

Dr. Pamala Crowell, Associate Dean for Research and Graduate Programs, School of Science, will provide the school administrative oversight.

Dr. Mathew Palakal, Professor and Chair, Department of Computer and Information Science will provide the department administrative oversight.

Dr. Yuni Xia, Assistant Professor, Department of Computer and Information Science will advise students.

## Faculty initially involved in the program and their credentials

### **Omran Bukhres**

**X3801**

Ph.D., North Dakota State University, 1990

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Dr. Bukhres is the co-principal investigator of the Large Scale Distributed Computing and Multimedia Laboratory. Research focuses: (1) database management systems for multimedia data, and (2) seamless integration of the distributed multimedia databases. Other research interests include: Transaction and Workflow Management, Multimedia Databases, Interoperability and Recovery in Heterogeneous Distributed Database Systems, Knowledge Base and Expert Systems, Mobile and Client Server Computing.

### **Yuanshun Dai**

**X0458**

Ph.D. in Computer Science, National University of Singapore, September 2003

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Computing Systems Reliability, Software/Hardware Reliability, Grid Computing, Parallel/Distributed Computing, Fault Tolerant Computing, System Modeling are Dr. Dai's specialties.

### **Shiaofen Fang**

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Ph.D., University of Utah, 1992

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Computer graphics, scientific visualization and geometric modeling are Dr. Fang's research specialties. Currently he is collaborating with biomedical researchers to apply computer graphics and visualization techniques, in particular volumetric modeling and visualization, for medical imaging applications.

### **Jeffrey Huang**

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Ph.D., George Mason University, 1998

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Jeffrey Huang's specialties and research interests include image processing, pattern recognition, computer vision, machine learning, and Evolutionary Computation (EC) on the applications of face recognition, Human Computer Interaction (HCI) and the interpretations of human activities, multimedia, computer visualization, medical imagery, and Automated Target/Object Recognition (ATR) and detection.

### **Snehasis Mukhopadhyay**

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Ph.D., Yale University, 1994

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Current research interests are adaption and learning in multi-level and distributed systems; information filtering and retrieval; modeling, simulation analysis and adaptive control of complex nonlinear systems using neural networks; design and analysis of intelligent controllers. Dr. Mukhopadhyay received a National Science Foundation Career Award.

### **Mathew Palakal**

**X0199**

Ph.D., Concordia University, 1987

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The development of Artificial Neural Network (ANN) models as learning and decision-making systems for various AI-related problems are of primary interest. He is involved in projects that include modeling Biosonar systems, neural network models to predict damages in materials and structures, and distributed information filtering.

**Rajeev Raje****X0328**

Ph.D., Syracuse University, 1994

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Dr. Raje is interested in the system and application aspects of the distributed-object model of computing. His current projects include the development of a seamless environment for net-centric applications, distributed information filtering, collaborative software engineering and visualization environments, and enhancement of different distributed-object models.

**Mihran Tuceryan****X0336**

Ph.D., University of Illinois-Urbana Champaign, 1986

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Dr. Tuceryan's research interests include augmented reality, model-based video coding, 3D computer graphics, 3D computer vision, and pattern recognition. Augmented Reality combines technologies from 3D computer graphics, visualization, advanced user interfaces, and 3D computer vision.

**Jiang Yu Zheng****X0384**

Ph.D., Osaka University, 1990

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Dr. Zheng's research interests include Computer Vision, 3D Modeling, Dynamic Image Processing Image Processing, Multimedia, Internet, Scene Representation Graphics, Virtual Reality, Digital Museum Sensor Information Processing, Robotics

**Xukai Zou****X0422**

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Applied cryptography and network security, Secure group communication: dynamic key, management, key agreement and distribution, Access control in distributed systems, Authentication and digital signature, data integrity and hash functions, Communication networks and wireless/mobile networks, Software engineering and Web/Internet technologies, Design and analysis of computer algorithms, Data/image processing compression.

**Admissions requirements and procedures****General Admission Requirements for the Graduate Certificate in Database****Datamining****Academic Standing**

The applicant's record should exhibit outstanding achievement as indicated by the grade point average (GPA) for each degree over his or her entire academic record. An applicant is expected to have at least a 3.0 GPA on a scale of 4.

**Core Background Requirements**

All Graduate Certificate applicants should have a background in the following core areas of computer science:

- Data Structures and Algorithms.
- Theory (discrete math and theory of computation).

In addition, applicants should have a strong background in mathematics, including calculus, linear algebra, and in numerical computations. For students who do not have a degree in Computer Science or related field, CSCI 362 (Data Structures) or an equivalent course is required with a grade of B+ or better.

### **TOEFL Scores for International Students**

All Graduate Certificate applicants whose native language is not English must submit a Test of English as a Foreign Language (TOEFL) score of at least 550 on paper based TOEFL and 250 on computer based TOEFL, or pass an equivalent test administered by IUPUI. These criteria are minimum requirements and the Department of Computer and Information Science may use additional criteria to make admission decisions. Potential applicants who have questions are advised to contact a Graduate advisor in the department.

Students admitted directly to the Computer Science Master of Science graduate program may earn this certificate in conjunction with their M.S. degree provided that all the requirements of the certificate program are satisfied.

### **Completion requirements and audit and certification procedures**

**Course Requirements:** 12 graduate credit hours are required. These include:

- One core course (3 credits),
- Three specialization courses (9 credits).
- **Specific Requirements**
  1. Core: 503 (Operating Systems) or 580 (Algorithms)
  2. 541 (Databases)
  3. 590 (Data Mining)
  4. 590 (Distributed Databases)

### **Minimum overall GPA**

Successful completion of the certificate requires at least a B average over all courses counting towards the certificate. Courses with a grade of C- or less must be taken again to count towards the certificate. The minimum grade that will be accepted in any single course is C.

### **Maximum number of credits that can be transferred from another institution**

Applicants who have already earned credit for one or more of the equivalent courses from other institutions and other certificate programs may request to apply up to a maximum of three credits of these courses toward this certificate. Any waivers or substitutions have to be approved by the committee that oversees the program.

### **Maximum number of undergraduate courses that can be applied**

No undergraduate courses can be applied to this certificate program.

### **Maximum time for completion**

All requirements for the certificate must be completed within three years. Most students enrolled in this program will be part-time students, employed full time. Thus two years may be needed for the completion of all courses if students take one course per semester.

### **Number of credit hours taken prior to admission to the certificate program that may be counted to completion of the degree**

Up to 6 equivalent credit hours taken prior to admission to the certificate program, including 3 hours taken from another institution, will be counted towards the certificate. The rest of the courses must be completed at IUPUI within a three-year period from the time of admission.

### **Course lists for the program including course descriptions**

**503 Operating Systems (3 cr.)** P: 403. Spring. Basic principles of operating systems: addressing modes, indexing, relative addressing, indirect addressing, stack maintenance; implementation of multitask systems; control and coordination of tasks, deadlocks, synchronization, mutual exclusion; storage management, segmentation, paging, virtual memory, protection, sharing, access control; file systems; resource management; evaluation and prediction of performance.

**580 Algorithm Design, Analysis, and Implementation (3 cr.)** P: 463 and 470. Basic techniques for designing and analyzing algorithms: dynamic programming, divide-and-conquer, balancing, upper and lower bounds on time and space costs, worst case and expected cost measures. A selection of applications such as disjoint set union/find, graph algorithms, search trees, pattern matching. The polynomial complexity classes P, NP, and co-NP; intractable problems.

**541 Database Systems (3 cr.)** P: 443 or equivalent. Spring. Fundamentals for the logical design of database systems. The entity-relationship model, semantic model, relational model, hierarchical model, network model. Implementations of the models. Design theory for relational databases. Design of query languages and the use of semantics for query optimization. Design and verification of integrity assertions, and security. Introduction to intelligent query processing and database machines.

**590 Data Mining (3 cr.)** *Data Mining* is an analytic process designed to explore data (usually large amounts of data - typically business or market related) in search of consistent patterns and/or systematic relationships between variables, and then to validate the findings by applying the detected patterns to new subsets of data. The ultimate goal of data mining is prediction - and predictive data mining is the most common type of data mining and one that has the most direct business applications. The process of data mining consists of three stages: (1) the initial exploration, (2) model building or pattern identification with validation/verification, and (3) deployment (i.e., the application of the model to new data in order to generate predictions).

**590 Distributed Databases (3 cr.)** Fundamental issues in distributed database systems that are motivated by the computer networking and distribution of processors and databases. The theory, design, specification, implementation, and performance of distributed database systems.

### **Procedures for governing the program including construction of committees that will provide oversight**

A committee comprised of Dr. Mathew Palakal, Dr. Yuni Xia and Dr. Snehasis Mukhopadhyay will jointly oversee the program. All advising will be done by these faculty members. The Department of Computer and Information Science and Ms. Myla Langford, the graduate coordinator, will take responsibility for all record keeping and tracking of students.

**Procedures for program evaluation including the criteria for success**

Upon completion of the program, exit interviews will be conducted for all students to determine the effectiveness of the program in meeting their needs and to identify how they are using the skills and tools learned in the program in their professions. Follow-up interviews will be conducted after three and five years. Given the projected enrollment of this program, and the fact many of the graduates will remain employed locally, it is anticipated that most students will be tracked this way.

Success of the program will be defined in terms of demand (enrollment) and the responses of the students surveyed upon completion of their degree and in the follow-up interviews.