

## PhD (Computer Science)

If your ambitions lie in carrying out cutting edge research in the field of Computer Science, gaining recognition for it and maintaining social and corporate networks in your field of study then an excellent option for you is to pursue your graduate studies at the IBA Faculty of Computer Science. The IBA Faculty of Computer Science (FCS) offers PhD programs in the following areas:

- Artificial Intelligence and Cognitive Robotics
- Wireless and Mobile Communications
- Social Computing
- Operations Research
- Management Information System
- Numerical Analysis and Computing
- Multimedia and Web
- Human Computer Interaction



The FCS PhD program aims at encouraging those graduate students who can make a significant contribution to their field through original research. The FCS hosts a number of research labs that are actively engaged in cutting edge research in a number of fields mentioned above. By being a part of this program, you will get an opportunity to establish linkages with international researchers publish scholarly articles and attend reputed conferences worldwide in your chosen discipline. Your quantitative and qualitative research capabilities will be polished and interdisciplinary research along with interaction with the local industry will always be encouraged.

The FCS PhD program motivates independence and originality of thought in the research process. The PhD program at IBA expects that not only will the graduates display excellence in their field of research but that the discipline, research and professional competencies they develop from this program will be highly regarded by national and international employers. To achieve this, students are expected to immerse themselves in research in order to develop a strong and vibrant research culture at the institute. The program requires a residency of at least two years where students are expected to complete a specially designed program comprising of advanced courses. During the residency program students are expected to attach themselves to a supervisor in their field of specialization. Students also avail a full Teaching / Research assistantship which comprises an attractive monthly stipend and full tuition fee waiver.

### Research Labs at FCS

As one of Pakistan's leading research institutions, Faculty of Computer Science (FCS) at IBA offers the best possible environment in which to undertake postgraduate research. A student conducting Masters or Doctoral

research will have the opportunity to be assigned to one of the following labs:

- Artificial Intelligence Lab
- Telecommunications Research Lab (TRL)
- Web Sciences Lab



### Web Sciences Lab

A new lab has been established at HBL-FCS Building to help researchers to undertake world class research in the area of Web Information Systems, with a special focus on Interactive Learning applications. The lab aims to conduct cutting edge research in diverse areas of web including information retrieval, social media, knowledge management, digital libraries, electronic commerce, and Semantic Web.

WWW is now considered as a main medium for sharing of data and metadata for knowledge management. Innovative models, frameworks, and methods are required to share, link and integrate data for efficient knowledge discovery and dissemination. WSL researchers are working on exploring new and innovative methods to improve existing web models and frameworks. The lab also aims to establish strong links with local industry to develop effective solutions for problems pertinent to Pakistani context.

In the domain of digital interactive learning, WSL researchers are working closely with ICT team of IBA to introduce MOOC (Massive Open Online Course) at IBA. Research is also being carried out to develop modern lifelong learning models.

### Telecommunications Research Lab

Telecommunications Research Lab (TRL) at the Faculty of Computer Science focuses on research in the areas of wireless and mobile networks. Specific topics under current research include the following: queuing modeling and analysis for energy, delay and other QoS parameters in Wireless Sensor Networks (WSN); Backhauling technologies in mobile networks; Implementation of WSN in Field for Monitoring, Irrigation; Energy Monitoring & Controlling System / Smart Asset Management using WSN and Hybrid networks; Traffic Congestion Tracking System.

The TRL is equipped with state of the art WSN equipment, including those from Memsic and Hanback, with a variety of sensors, including light, temperature, humidity, barometric pressure, seismic, GPS, acoustic, acoustic actuator, magnetometer, 3-Axis Acceleration and RFID readers. WSN Motes include IEEE 802.15.4 / ZigBee Compliant Iris and MICAz (2.4 GHz) Motes, supporting both TinyOS 1.x and 2.x.

Simulation tools include Qualnet v5.0, NS2 and LabView. A modern Cisco networking lab is also available for research on core routing issues, network security and VOIP. Faculty, PhD Scholars and students at TRL contributes frequently to publications in international conferences and journals. PhD Scholars attend international workshops and training sessions that contribute to their self-development skills in using simulation tools as well as in gaining hands-on experience with advanced networking devices.



### Artificial Intelligence Lab

Artificial Intelligence Lab at IBA endeavors to provide a platform for researchers and professionals to manifest their innovative capabilities through development of sophisticated research projects. The lab also aims to foster collaboration with local industry by developing intelligent solutions for problems pertinent to Pakistani market. Being established in 2008, AI LAB at IBA is a dynamically growing research center focusing in the core areas of AI namely data analytics, machine learning, semantic web, computational intelligence, probabilistic reasoning, and cognitive robotics. The following list highlights its key activities:

- AI Lab has partnered with the Innovation and Enterprise Research Lab of the University of Technology, Sydney to form a joint RoboCup Soccer team, Karachi Koalas, under 3D simulation league. The team was established in 2010 and has since then participated in 2011, 2012 and 2013 World RoboCup held in Turkey, Mexico and the Netherlands, respectively. The

team is currently ranked 5th in the World which is a remarkable achievement for a team that is only few years old. The team's performance has been covered on Geo and Samaa tv channels.

- The lab frequently organizes robotics workshop for high school students and teachers. The purpose of these workshops is not only to expose our youth to the exciting field of Robotics / Artificial Intelligence but to also train the human resource involved in teaching science and related subjects at the high school level.
- In collaboration with our industry partner, Credit-Chex, we have developed an Anti-Money Laundering System (AMLS). It serves as a decision support tool and aids financial institutions and State Bank in identifying suspicious financial transactions and in curbing anti money laundering activities. The product was developed under a research grant provided by the National ICT R&D Fund.

- In the area of data analytics, the lab is maintaining active contacts with industry leaders such as EMC2 and KNIME.
- The lab also organizes data analytics workshop for professionals. The purpose of this activity is not only to bridge the gap between industry and academia but also to train the workforce for the emerging challenge of big data analytics.
- The lab hosts 2 state-of-the-art AldebaranNao robots. The robots are amongst the most sophisticated humanoid robots available for public use. They feature 25 degrees of freedom which allows them to produce human like walks and movements. In addition, they contain eight force-sensing resistors and two touch sensors.
- The lab is also a home for TurtleBot and Lego Mindstorms robots which are a great resource for teaching the fundamentals of cognitive robotics.
- A team, Karachi Chotu, for RoboCup @ Home has been established in 2013. A team, Karachi Chotu, for RoboCup @Home has been established in 2013. The team secured 3rd position in IranOpenRoboCup 2014 that was attended by many international teams. With the help of this initiative, the lab aims to develop service and assistive robot technology with high relevance for future personal domestic applications.
- AI Lab has developed and released BNOSA (Bayesian Network and Ontology based Semantic Annotation) which is a framework for semantic annotation of unstructured, ungrammatical and incoherent data sources using ontology and Bayesian networks.
- Another tool released by the AI Lab is IBAyes which is a probabilistic reasoning tool that allows a user to model uncertain situations and to perform inference using Bayesian networks and Influence Nets. It is freely available for download from the lab website.

For a Detailed PhD Prospectus, Please Visit:  
[cs.iba.edu.pk / programs.html](http://cs.iba.edu.pk/programs.html)

