



# Research Group of Vision and Pattern Recognition Systems (VisPRS)



## GROUP INTRODUCTION

Vision and Pattern Recognition Group of Capital University of Science & Technology is actively involved in basic and applied research in the fields of Image Processing, Machine/Computer Vision and Pattern Recognition/Classification. The scope of research not only includes the algorithm development and analysis but also system development and the optimizations involved. Presently this group has more than 20 members including 6 MS students, 12 PhD scholars and 3 post doctoral researchers belonging to different organizations.

## GROUP HEAD

### Dr. Imtiaz Ahmad Taj

Dr. Imtiaz Ahmad Taj received his PhD degree in Electronics and Information Engineering from Hokkaido University, Sapporo, Japan where he was endowed with Outstanding Young Researcher Award by IEICE Japan. He is actively involved in Teaching, Research and Academic Management. Currently he holds the Office of Dean Faculty of Engineering at Capital University of Science and Technology, Islamabad. He also remained on key positions in various R&D companies notably CET and CARE. Dr. Imtiaz Ahmad has been teaching and doing research in Machine vision, Pattern Recognition & Biometrics, Optical Networking, Nonlinear Optics, Photorefractive Wave Mixing, Free-space Optical Switching etc. He introduced several graduate level academic courses for the first time in Pakistan including Computer Vision, Pattern Recognition and Machine learning. Under his supervision, more than 20 students have successfully completed their research thesis at MS and PhD level and still a number of students are pursuing their research with him. He has accomplished more than 60 Publications in national and international Journals & Conferences of highest repute. He has served in organizing and technical committees of many international Journals & Conferences. He has successfully completed three national level research projects in the capacity of Project director leading a team of more than 15 researchers in each project. He also remained member and chaired various Professional and Non Professional bodies and organizations.



## RESEARCH AREAS

- Biometrics: Fingerprint, Iris, Face, Palm print and Signature
- Video Encoding and Processing
- Machine Learning and Deep Neural Networks
- Super Resolution Imaging
- Vision Based Navigation & Registration, Vision Based Tracking
- Time Frequency Analysis of Dynamic Signals
- Automatic Activity Detection and Vision Based Security Systems
- Medical Diagnosis using Pattern Classification Algorithms
- Algorithm Development & Hardware Design

## R&D Projects

1. Design and Development of on-board Image Registration and Position Estimation System for Autonomous Vehicle Navigation
2. Automatic Personal Identification Biometrics System (APIBS) for Large Scale Applications
3. Real Time Implementation of H.264 Decoder for Heterogeneous Multicore Architectures

## PhD ALUMNI

### Dr. Muhammad Naeem Ratyal

**Thesis Title:** 3d Face Recognition Based On Pose And Expression Invariant Alignment  
**Year:** 2016

### Dr. Muhammad Sajid

**Thesis Title:** Towards Facial Asymmetry Based Face Recognition  
**Year:** 2016

### Dr. Muhammad Asif

**Thesis Title:** Efficient Framework For Macroblock Prediction And Parallel Task Assignment In Video Coding  
**Year:** 2016

### Dr. Mubeen Ghafoor

**Thesis Title:** Fingerprint Enhancement and Nonlinear Distortion Removal by effective use of Contextual filtering  
**Year:** 2014

### Dr. Muhammad Ajab

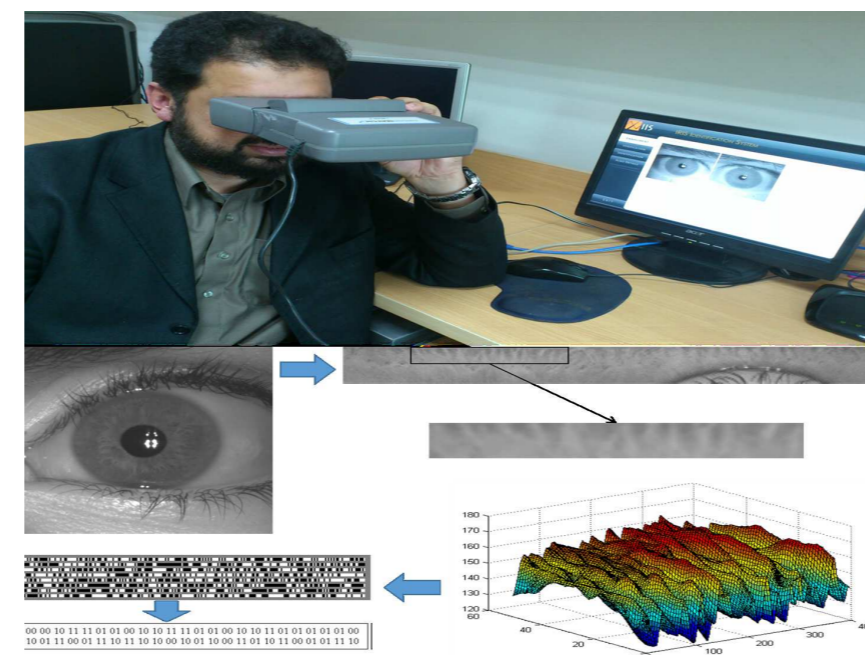
**Thesis Title:** A Combination of Linear and Quadratic Time- Frequency Techniques for Time-Varying Signals  
**Year:** 2013

### Dr. Usama Ijaz Bajwa

**Thesis Title:** Performance Enhancement of Subspace Learning Face Recognition by Effective Use of Classifiers  
**Year:** 2013

### Dr. Nabeel Ali Khan

**Thesis Title:** Cross-term Suppression in Wigner Distribution  
**Year:** 2010



## Current PhD Students

1. Mr. Ahmad Bilal Mehmood
2. Ms. Samana Batool
3. Mr. Aamir Javed
4. Ms. Keenjhar Ayooob Chandio
5. Mr. Muhammad Tahir Awan

## Selected Publications

### Journal Publications

- T. Zia, M. Ghafoor, S. A. Tariq, and I. A. Taj, "Robust Fingerprint Classification with Bayesian Convolutional Networks", *IET Image Processing*, vol. 13, no. 3, pp. 1–10, 2019, (I.F: 1.401).
- M. Tahir, I. A. Taj, P. A. Assuncao, and M. Asif, "Fast Video Encoding based on Random Forests", *Journal of Real-Time Image Processing*, vol. 16, no. 10, pp. 1–21, 2019, (I.F: 1.574).
- M. Sajid, I. A. Taj, U. I. Bajwa, and N. I. Ratyal, "Facial asymmetry based Age Group Estimation: Role in Recognizing Age-Separated Face Images", *Journal of Forensic Sciences*, vol. 63, no. 6, pp. 1727–1749, 2018, (I.F: 1.184).
- N. I. Ratyal, I. A. Taj, U. I. Bajwa, and M. Sajid, "Pose and expression invariant alignment based multi-view 3D face recognition", *KSII Transactions on Internet and Information Systems*, vol. 12, no. 10, pp. 4903–4929, 2018, (I.F: 0.601).
- M. Asif, I. A. Taj, S. M. Ziauddin, M. B. Ahmad, and M. Tahir, "An efficient framework for prediction parameters selection in advanced video coding", *IEEE Access*, vol. 6, pp. 25277–25291, 2018, (I.F: 3.557).
- M. Ghafoor, S. Iqbal, S. A. Tariq, I. A. Taj, and N. M. Jafri, "Efficient Fingerprint Matching Using Graphical Processing Unit", *IET Image Processing*, vol. 12, no. 2, pp. 274–284, 2018, (I.F: 1.401).
- S. A. Tariq, S. Iqbal, M. Ghafoor, I. A. Taj, N. M. Jafri, S. Razzar, and T. Zia, "Massively parallel palmprint identification system using GPU", *Cluster Computing Springer*, vol. 20, no. 3, pp. 1–16, 2017, (I.F: 1.602).
- M. Ghafoor, I. A. Taj, and N. M. Jafri, "Fingerprint Frequency Normalization and Enhancement using 2-D STFT Analysis", *IET Computer Vision*, vol. 10, no. 8, pp. 806–816, 2016, (I.F: 1.087).
- M. Sajid, I. A. Taj, U. I. Bajwa, and N. I. Ratyal, "The Role of Facial Asymmetry towards Recognizing Age-Separated Face Images", *Computers & Electrical Engineering (Elsevier)*, vol. 54, pp. 255–270, 2016, (I.F: 1.747).
- M. Asif, Imtiaz A. Taj, S.M. Ziauddin, M.B. Ahmad, M. Tahir, "A Hybrid Scheme Based on Pipelining and Multitasking in Mobile Application Processors for Advanced Video Coding", *Scientific Programming, Hindawi Publishing Corporation*, vol. 2015, no. 2, pp. 1–16, 2015, (I.F: 1.344).
- N. I. Ratyal, I. A. Taj, U. I. Bajwa, and M. Sajid, "3D face recognition based on pose and expression invariant alignment", *Computers & Electrical Engineering (Elsevier)*, vol. 46, pp. 241–255, 2015, (I.F: 1.747).
- M. Ghafoor, I. A. Taj, W. Ahmad, and N. M. Jafri, "Efficient 2-fold contextual filtering approach for fingerprint enhancement", *IET Image Processing*, vol. 8, no. 7, pp. 417–425, 2014, (I.F: 1.401).
- U. I. Bajwa, I. A. Taj, M. W. Anwar, and X. Wang, "A Multifaceted Independent Performance Analysis of Facial Subspace Recognition Algorithms", *PLoS ONE*, vol. 8, no. 2, pp.e56510, 2013, (I.F: 2.766).