PERSONAL INFORMATION

ZAKIA KHATUN

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Sex Female   **| Date of birth** 02.02.1996   **| Nationality** Bangladeshi (By Birth)

EDUCATION

10/09/2018 - 11/09/2020

ERASMUS Mundus Joint Master degree in 'Medical Imaging and Applications'

▪ First Semester @**University of Burgundy** (France); Earned 30 ECTS which includes the following courses:
- Medical Sensors,
- Image processing,
- Digital Signal Processing,
- Software Engineering, &
- Applied Mathematics.

▪ Second Semester @**University of Cassino and Southern Lazio** (Italy); Earned 30 ECTS which includes:
- Pattern Recognition and Machine Learning,
- Advanced Image Analysis,
- Distributed Programming and Networking,
- Parallel Processing Systems, &
- Introduction to Robotics.

▪ Third Semester @**University of Girona** (Spain); Earned 30 ECTS which includes the following:
- Computer Aided Diagnosis,
- Medical Image Registration and Applications,
- Medical Image Segmentation and Applications,
- Computer Aided Surgery and Medical Robotics, &
- eHealth.

▪ Master's thesis @ **Pascal Institute – EnCoV** (France)

▪ **Projects (Completed)**:

1) To design, analyze and implement approaches for brain tissue segmentation.
2) What about being a neuropsychologist? (eHealth Lecture activity)
3) Developing Computer Aided algorithm for the diagnosis in histopathological images to classify benign vs malignant using deep learning approach.
4) Developing Computer Aided Algorithm for the diagnosis in Dermoscopic images to classify melanoma vs all other types using deep learning approach.
5) Image registration of chest CT volumes: 4DCT DIR-Lab Challenge (https://www.dir-lab.com/).
6) Demonstration of Medical Robotics in Spine Surgery using Tx60 Staubli Robot.
7) Breast Mass Detection using Machine Learning Algorithm.
8) CT Reconstruction using parallelization Strategy.
9) Vision Application (VIZN) using JAVA.
10) Designing an Inverse Kinematics Controller following different tasks.
11) Automatic MRI Cardiac Segmentation in Short Axis for Left Ventricular Endocardium.
12) Interest Points Detection on 3D Meshes Using Harris Operator.
13) Automated Inspection at soft drink bottling plant.
14) Face Recognition using Principal Component Analysis.

▪ **Master's Thesis**:

Survival Time Prediction of Metastatic Melanoma Patients by Computed Tomography using Convolutional Neural Networks.

10/05/2014 – 03/02/2018

Bachelor of Science in Electrical & Electronic Engineering   EQF Level-6

American International University-Bangladesh (AIUB), Dhaka, Bangladesh

▪ Earned 145 Credits.
▪ Major in "Biomedical Instrumentation Measurement and Design''.
▪ **Undergraduate Project Title:** Gesture Controlled Pick and Place Robot (***Dean's Award Winner)***.
▪ **CGPA: 3.97 on a scale of 4.00.**

Pascal Institute - EnCoV (4th semester):

Master's Thesis
01/02/2020-24/07/2020

Survival Time Prediction of Metastatic Melanoma Patients by Computed Tomography using Convolutional Neural Networks

- The main goal is to predict the survival time of patients with metastatic melanoma in terms of 1-year survival as binary classification using CNNs.
- **Dataset**: 71 patients with metastatic melanoma (Studied at Universite Clermont Auvergne Hospital).
- **Baselines:** 1) **Baseline 1**: Survival time prediction in terms of 1-year survival using CT data as input.
  2) **Baseline 2**: Survival time prediction based on multi-organ lesion segmentation.
  3) **Baseline 3**: Survival time prediction in terms of 1-year survival using aggregated deep segmentation feature map as additional input channel to CT data.

University of Girona - UdG (3rd semester):

20/09/2019-08/01/2020

To design, analyze and implement approaches for brain tissue segmentation

- The goal of this project is to develop tissue (WM, GM, and CSF) segmentation methods in brain MRI images.
- **Dataset**: IBSR18. Dataset contains 18 skull-stripped and bias field corrected T1-w images with different spatial resolutions (pixel spacing) and there is a heterogeneity in image intensities which hinders segmentation.
- **System architecture**: *Data → Pre-processing → Segmentation.*
- **Steps**: 1) **Pre-processing**: a) Normalization and Skull stripping of MNI template.
  b) Image Registration
  - We have used *Elastix* as a software to apply 3D registration of moving image on fixed.
  c) Histogram Stretching
  - The registered volumes' histograms have been stretched which broadens the histogram of the image intensity levels.
  d) Histogram Matching
  - Histogram stretched output of IBSR 07 has been taken as reference to match all other volumes' stretched histogram.
  2) **Segmentation**: 3D patch-wise segmentation using 3D U-Net.

28/09/2019-05/01/2020

What about being a neuropsychologist?

- This lecture activity was an open field to choose topic to provide lecture and organize interactive session. **Theme**: Clinical Assessment.
- **Lecture activity structure**: a) Neurological diseases overview.
  b) Explaining 3 specific Neurocognitive domains
  - Learning and Memory (Alzheimer diseases, Traumatic Brain Injury).
  - Perceptual Motor Function (Parkinson's diseases, Motor Neuron Disease).
  - Social Cognition (Bipolar Disorder, Anxiety disorder).
  c) Neurocognitive assessments in the clinical practice.
  d) Interactive game session after lecture
  - Each team member acts as a neuropsychologist and asking questions of other team members or observing posture or other symptoms must guess the disease.

25/09/2019-05/01/2020

Developing Computer Aided Algorithm for the diagnosis in Dermoscopic images to classify melanoma vs all other types using deep learning approach

- Aim of this project was to design a Computer Aided Diagnosis system to classify dermoscopic images whether any case belongs to Nevus or lesion.
- **System architecture**: *Image → Normalization → Per instance standardization → Aggressive Data Augmentation → Classification*
- **Steps**: 1) **Normalization**: Data normalization.
  2) **Per instance standardization**: Standardization by mean and std of the training dataset.
  3) **Aggressive Data Augmentation**: Rotation, Width and Height shift, Zooming, Flipping, Brightness.
  4) **Classification**; Best performing classification model: Ensemble of Inception ResNetv2, Inception v3, EfficientNet B3 (*ImageNet-pretrained*).

| 28/09/2019-05/01/2020 | **Developing Computer Aided algorithm for the diagnosis in histopathological images to classify benign vs malignant using deep learning approach** |

- The main objective of this project was to design a Computer Aided Diagnosis system to develop a deep learning algorithm for diagnosis in histological patches. Focus of this study was to classify benign vs malignant patches.
- **System architecture**: *Image → Normalization → Per instance standardization → Aggressive Data Augmentation → Classification*

- **Steps**: 1) **Normalization**: Data normalization.
  2) **Per instance standardization**: Standardization by mean and std of the training dataset.
  3) **Aggressive Data Augmentation**: Horizontal flip, Vertical flip.
  4) **Classification**: Best performing classification model: ResnNet50 (*ImageNet-pretrained*).

| 26/09/2019-03/01/2020 | **Image registration of chest CT volumes: 4DCT DIR-Lab Challenge** |

- This project aims to register 3D CT lung images.
- Project tested on first 4 cases available on 4DCT DIR-Lab Challenge.
- Data with 300 landmark annotations.
- Evaluation using TRE 3D Euclidean distance between transformed landmarks.

| 20/09/2019-02/01/2020 | **Demonstration of Medical Robotics in Spine Surgery using Tx60 Staubli Robot** |

- The goal of this project was to demonstrate pedicle screw placement for spine fusion.
- **Steps**: 1) Trajectory planning (*Type of movement: Point to point*).
  2) Software simulation of robotic spine surgery (*Stäubli Robotics Suite*).
  3) Testing demo surgery using Tx60 Stabuli.

University of Cassino and Southern Lazio (2nd semester):

| 25/02/2019-06/06/2019 | **Breast Mass Detection using Machine Learning algorithm** |

- The main aim of this project was to design a Computer Aided Diagnosis system which can detect mass/masses in mammograms to help the screening procedure.
- **System architecture**: *Image → Candidate extraction → Feature extraction → Classification*.

- **Steps**: 1) **Candidate extraction**: Histogram equalization → Multiple thresholding → Selection of n best threshold using mean and variance → Selection of desired threshold based on chosen threshold.
  2) **Feature extraction**: Three types of features used are shape, texture (*Haralick*) and Intensity features.
  3) **Classification**: Different type of classifiers were tested both individually and as a cascade of two or more to evaluate performance. At the end, the voting between Gaussian Naïve Bayes and Logistic regression was used where this voting is an AND combination of two classifiers.

| 20/02/2019-08/06/2019 | **CT Reconstruction using Parallelization Strategy** |

- This project proposes a discrete image reconstruction algorithm using parallel beam geometry where a set of X-ray beams are passed through the object of interest and intensity variations of the beams at input and output are measured.

- To reconstruct, filtered back projection is used which uses a 1D filter on the projection data before back projecting (2D or 3D) the data onto the image space.

| 02/03/2019-16/06/2019 | **Vision Application (VIZN)** |

- VIZN application provides an environment where user will be able to test some performance related to the eyesight, Observing the evolution over time by the means of innovative user controls.

- Tests prepared in scientific way.

| 18/02/2019-13/06/2019 | **Designing an Inverse Kinematics Controller** |

- Purpose of this project was to design an Inverse Kinematic controller for Kinova Jaco2 robot following some given tasks.

- **Task1**: The control objective is position only without exploiting the redundancy.

- **Task2**: The control objective is given by both the position and the orientation. While the position needs to move according to the indications above, the orientation needs to be controlled such that it is kept constant at the initial value.

- **Task3**: The end-effector orientation needs to be changed.
- **Task4**: The redundancy needs to be exploited by maximizing the manipulability.

University of Burgundy (1st semester):

15/09/2018-05/01/2019 **Automatic MRI Cardiac Segmentation in Short Axis for Left Ventricular Endocardium**
- Main aim of this project was improving the accuracy of automatic Left ventricular (LV) segmentation in short axis cardiac cine MR images.
- **Steps**: 1) Quantifying motion to determine an initial region of interest surrounding the heart.
    2) Identifying potential 2D objects of interest using an intensity-based segmentation.
    3) Assessing contraction/expansion, circularity, and proximity to lung tissue to score all objects of interest in terms of their likelihood of constituting part of the LV and Aggregating the objects into connected groups and construct the final LV blood pool volume and centroid

21/09/2018 – 07/01/2019 **Interest Points Detection on 3D Meshes Using Harris Operator**
- In this project, an adaptive technique was implemented to determine interest points or 3D objects based on Harris operator which is done by determining neighborhood of a vertex over which Harris response on that is calculated.
- **Steps**: 1) For each vertex of mesh, forming a region of interest and it's K neighborhood rings where all the rings are set of points.
    2) Finding harris response.
    3) Getting initial interest points.
    4) Getting final interest points (*either by selection fraction method or by clustering*).
    5) 3D rendering.
    6) Designing graphical user interface.

15/09/2018 – 10/01/2019 **Automated Inspection at soft drink bottling plant**
- In this project to develop a visual inspection system the following fault conditions were aimed to be detected: 1) Bottle under filled, 2) Bottle over filled, 3) Bottle has label missing, 4) Bottle has label but label printing was failed, 5) Bottle label is not straight, 6) Bottle cap is missing, 7) Bottle is deformed in some way.
- Background studies include extracting region of interest, computing mean gray level, binarizing any chosen. region of interest with a particular thresholding, computing percentage of black pixels and comparing to normal bottle values, extracting red channel, edge detection and obtaining connected components & their bounding boxes, finding largest bounding box, comparing area, height & width to the normal. Depending on the fault condition different types of step were applied.
- A simple graphical user interface was designed.

19/09/2018 – 08/01/2019 **Face Recognition using Principal Component Analysis**
- In this project a simple face recognition system was designed based on few training images.
- **Steps**: 1) Data normalization
    2) Face recognition
- Normalization of the training data set and principle component analysis was incorporated &
- A simple Graphical User Interface was designed.

24/04/2017 – 02/12/2017 **Undergrad Final Year Thesis: Gesture Controlled Pick & Place Robot**
- In this project, a gesture-controlled pick and place robot was proposed with a drive system. This design is wirelessly controllable using a hand module. Main purpose was to aid physically disabled people to manipulate an object as they wish. Moreover, will be useful in industrial works as it has the option of mobility, a trait that conventional pick and place robots do not have.

- Background studies include wireless controlling, degrees of freedom, different sensors (*accelerometer, flex & ultrasonic*).

PROGRAMMING SKILLS Python, MATLAB, C++, JAVA, Arduino Coding
SOFTWARE Elastix, ITK-Snap, MITK, Visual Studio C++, Proteus, NI Multisim, Arduino IDE, Autodesk AutoCAD

CO-CURRICULAR EXPERIENCES

2016-2017	**Vice Chairperson** **IEEE AIUB Student Branch Women in Engineering Affinity Group (WIE)** ▪ Organizing different seminars and events specially for women empowerment	04/12/2016-24/12/2016	**Member of Event Coordination Committee** **IEEE Region-10 Student Professional Awareness Venture (SPAVe), supported by IEEE USA**
02/10/2016 – 04/11/2016	**Campus Ambassador** **IEEE Bangladesh Section SYW Congress 2016** ▪ Contacting organizational unit (*section, student branch, affinity group etc.*) chairs to inform them about IEEE Day. ▪ Communication with Ambassador on progression of planning events.	10/06/2016-22/07/2016	**Volunteer** **AIUB Engineering Jubilation-2016** ▪ Responsible for organizing the event which includes public relations with students, arranging different competitions for students based in engineering knowledge.

HONOURS AND ACHIEVEMENTS

- **Erasmus Mundus Joint Master (EMJMD) Scholarship** for master's in Medical Imaging and Applications; covering full tuition fees and monthly stipend (Total **42,000 EUR**).
- **Dean's Award** for Undergraduate Final Year Project, Securing 7th Place out of 180 Projects/Theses for the Academic Year 2017-2018 at AIUB.
- **Academic Scholarship** from American International University-Bangladesh (AIUB) for exceptional performance throughout the academic years (Around **300,000 BDT**).

LANGUAGE SKILLS

Mother tongue   Bengali
Other language   English

UNDERSTANDING		SPEAKING		WRITING
Listening	Reading	Spoken interaction	Spoken production	
B2	B2	B2	B2	B2
Medium of Instruction certificate from undergrad university				

REFERENCE

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3) Md. Saniat Rahman Zishan
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