KCDH Proposed Ph. D. topics for Admission : 2023-2024

1. **Using machine learning approaches for analyzing and enhancing molecular dynamics simulations of protein-protein and protein-drug interactions**

   Research area of project - Computational Biology and Bioinformatics

   Supervisor - Prof. Ambarish Kunwar

   Webpage of the supervisor - https://www.bio.iitb.ac.in/~akunwar/

2. **Motion and Gait Planning of Bio-inspired Robots using Machine Learning Algorithms**

   Research area of project - Healthcare Applications

   Supervisor - Prof. Ambarish Kunwar

   Webpage of the supervisor - https://www.bio.iitb.ac.in/~akunwar/

3. **Statistical models for characterizing similar cell states for community scale single-cell data**

   Research area of project - Computational Biology and Bioinformatics:

   Supervisor - Dr. Saket Choudhary

   Webpage of the supervisor -https://www.linkedin.com/in/saket-choudhary/

   Abstract: Single-cell data has seen exponential growth over the past decade. The development of molecular 'atlases' has provided unprecedented resolution for deciphering molecular mechanisms of gene regulation in the human body. However, these datasets remain largely unexplored from an 'integration' viewpoint - what and how molecular mechanisms get rewired in diseases. The goal of this project would be to develop large-scale statistical models to a) 'harmonize' cellular states across individuals, b) Decipher celltype-specific changes in molecular states across individuals, c) Identify the impact of covariates (sex, age, ethnicity) on changes in molecular states across individuals with a particular focus on diseases and ultimately d) developing a mechanistic understanding of how changes in DNA sequence drive the changes characterized as parts of aims b and c. Besides deciphering the mechanistic principle of gene regulation that will have a huge translational impact, the student will get extensive training in analyzing large-scale single-cell data and developing

statistical models for interpreting genomics data applicable to the broader single-cell and bioinformatics community.

4. **Development of Wearable healthcare devices**

   Research area of project - Healthcare Applications

   Supervisor - Prof. Dipti Gupta

   Webpage of the supervisor - https://sites.google.com/site/plasticoptoelectronicslab/home/professor

5. **Development of wearable devices for remote patient monitoring**

   Research area of project - Healthcare Applications

   Supervisor - Prof. Dipti Gupta

   Webpage of the supervisor - https://sites.google.com/site/plasticoptoelectronicslab/home/professor

6. **Understanding the mechanistic insights of brain tumors through integrated Omics analysis**

   Research area of project - Healthcare Applications

   Supervisor - Prof. Sanjeeva Srivastava

   Webpage of the supervisor -https://www.bio.iitb.ac.in/~sanjeeva/

7. **Developing computational tools for optical tomography in human brain using laser speckles.**

   Research area of project - Healthcare Applications

   Supervisor - Prof. Hari M Varma

   Webpage of the supervisor - https://www.bio.iitb.ac.in/~harivarma/

   Abstract : When the tissue is illuminated with a focused near infrared laser, it generates an interference pattern called speckles. Speckles can be deployed to measure both superficial flow in human skin and deep tissue blood flow in human brain. We have recently introduced stochastic differential equation (SDE) for laser speckle simulation. We are currently working on developing a rigorous SDE-based model for the diffuse speckles deployed for deep tissue imaging. The project involves developing solvers for SDE, Monte Carlo models for light propagation in tissue and python interface for data acquisition for in-house build experimental set-up for brain imaging. The project will be translated to clinic for imaging in stroke patients.

8. **Phono-angiography based early prediction of Stenosis and Aneurysms**

   Research area of project - Healthcare Applications, Healthcare Analytics and AI/ML., Computational Biology and Bioinformatics

   Supervisor - Prof. Janani Srree Murallidharan

   Webpage of the supervisor -
   https://www.me.iitb.ac.in/?q=faculty/Prof.%20Janani%20Srree%20Murallidharan

9. **Machine Learning applied to prediction of Cardio Vascular Diseases**

   Research area of project - Healthcare Analytics and AI/ML.

   Supervisor - Prof. Janani Srree Murallidharan

   Webpage of the supervisor -
   https://www.me.iitb.ac.in/?q=faculty/Prof.%20Janani%20Srree%20Murallidharan

10. **Pattern Recognition-AI and NMR aided HOS analysis for Structural similarity of Biological Drugs**

    Research area of project - Healthcare Applications.

    Supervisor - Prof. Ashutosh Kumar

    Webpage of the supervisor - https://www.bio.iitb.ac.in/~ashutoshk/

    Co-supervisor - Prof. Manjesh K Hanwal

    Webpage of the Co-supervisor -
    https://www.ieor.iitb.ac.in/files/faculty/mhanawal/index.html

11. **Novel proteomic approaches to characterise horizontal gene transfer using an in-vivo and in-vitro mouse-human hybrid model**

    Research area of project - Healthcare Applications
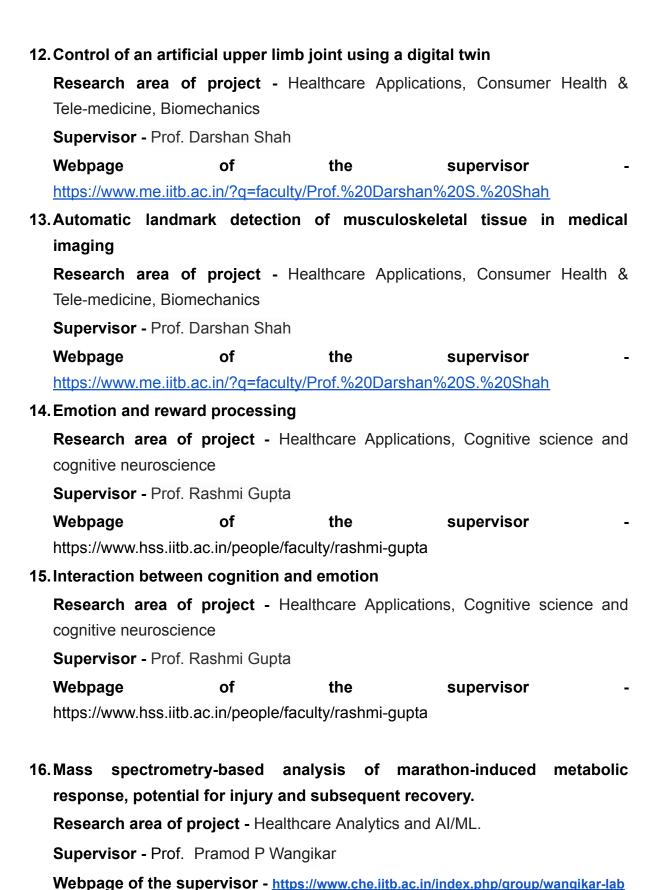
    Supervisor - Prof.Sanjeeva Srivastava

    Webpage of the supervisor -
    https://www.bio.iitb.ac.in/people/faculty/srivastava-s/

    Co-supervisor - Indraneel Mittra, Tata Memorial Hospital

    Webpage of the Co-supervisor - https://actrec.gov.in/dr-indraneel-mittra

12. **Control of an artificial upper limb joint using a digital twin**

    Research area of project - Healthcare Applications, Consumer Health & Tele-medicine, Biomechanics

    Supervisor - Prof. Darshan Shah

    Webpage of the supervisor - https://www.me.iitb.ac.in/?q=faculty/Prof.%20Darshan%20S.%20Shah

13. **Automatic landmark detection of musculoskeletal tissue in medical imaging**

    Research area of project - Healthcare Applications, Consumer Health & Tele-medicine, Biomechanics

    Supervisor - Prof. Darshan Shah

    Webpage of the supervisor - https://www.me.iitb.ac.in/?q=faculty/Prof.%20Darshan%20S.%20Shah

14. **Emotion and reward processing**

    Research area of project - Healthcare Applications, Cognitive science and cognitive neuroscience

    Supervisor - Prof. Rashmi Gupta

    Webpage of the supervisor - https://www.hss.iitb.ac.in/people/faculty/rashmi-gupta

15. **Interaction between cognition and emotion**

    Research area of project - Healthcare Applications, Cognitive science and cognitive neuroscience

    Supervisor - Prof. Rashmi Gupta

    Webpage of the supervisor - https://www.hss.iitb.ac.in/people/faculty/rashmi-gupta

16. **Mass spectrometry-based analysis of marathon-induced metabolic response, potential for injury and subsequent recovery.**

    Research area of project - Healthcare Analytics and AI/ML.

    Supervisor - Prof. Pramod P Wangikar

    Webpage of the supervisor - https://www.che.iitb.ac.in/index.php/group/wangikar-lab

17. **Genome-scale metabolic modeling and dynamic flux balance analysis of CHO cell cultures.**

    Research area of project - Healthcare Analytics and AI/ML., Computational Biology and Bioinformatics:

    Supervisor - Prof. Pramod P Wangikar

    Webpage of the supervisor - https://www.che.iitb.ac.in/index.php/group/wangikar-lab