- Working on problems based on artificial intelligence-based biosensors, Electrochemical biosensors, wearable biosensors etc. for various applications related to society
- Building machine learning models on various datasets specially related to health issues for the identification, diagnosis or prediction of the disease
- Computational modeling/ simulation of nanoparticles and their usage in drug delivery applications for various diseases. Examples can be like neuro-simulation of drug-loaded nanoparticles for understanding the pathway for diseases like mental depressive disorders.

**Essential/recommended readings**

- Sensing and Artificial Intelligence Solutions for Food Manufacturing; Editors: Charles Oluwaseun Adetunji, Daniel Hefft, CRC Press
- Mathematical Modeling of Biosensors by Romas Baronas, Felikas Ivanauskas, Juozas Kulys, (2021); Springer International publishing
- Biosensors and Nanotechnology: Applications in Health Care Diagnostics (2017), Editor: Zeynep Altintas; Wiley Publishers
- Research papers/ Reviews from peer reviewed reputed journals, related to the identified problem/ issue

## DISCIPLINE SPECIFIC ELECTIVE COURSE -4 (DSE-4)
## VI.5.4. Medical Imaging Techniques

**CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE**

| Course title & Code | Credits | Credit distribution of the course | | | Eligibility criteria | Pre-requisite of the course (if any) |
|---|---|---|---|---|---|---|
| | | Lecture | Tutorial | Practical/ Practice | | |
| **Medical Imaging Techniques#, DSE-4, VI.5.4** | **4** | **0** | **0** | **4** | **12th Pass** | **Basic knowledge of python** |

**#This course will also be available to the students in semester IV**

**Learning Objectives**

This practical paper is designed to provide hands on experience to build data driven module for computer vision, with applications in medical image analysis. This practical paper enables the students to build deep learning architecture, such as filters, activation functions, loss functions; regularization techniques such as e.g. batch normalization and dropout. Student can implement different non-linear optimization algorithms that are used when training the medical imaging networks on different imaging tools.

**Learning outcomes**

- Training and validation of image dataset, classification and regression, supervised and unsupervised learning, bias and variance, loss function, generalization error, accuracy, precision, to medical image dataset.
- Can implement deep learning parameters, such as e.g. depth, learning rate, hyper parameter, overtraining and regularization in softwares.
- Implementation of different deep learning architecture for classification and segmentation of diagnosis of various diseases.
- Can simulate hybrid deep learning architecture and models used in medical imaging.

**Syllabus**

**Practicals - (120 Hours)**

- Implementation of basic Medical imaging tools.
- Feature extraction, segmentation, systematic evaluation and validation on medical image datasets using data driven architectures.
- Designing different machine learning and deep learning based models for segmentation and classification of medical imaging datasets.
- Performance analysis of different deep learning architecture in terms of statistical parameters.
- Case studies on some recent advances in analysis of retinal, CT, MRI, ultrasound and histology images.

**Essential/recommended readings**


1. The Handbook of Medical Image Perception and Techniques, by Ehsan Samei and Elizabeth A. Krupinski, second edition, Publisher Cambridge University Press.
2. Medical Imaging by DS Guru, K.C. Santosh, Nilanjan Dey, Sameer Antani, Publisher CRC Press.


## DISCIPLINE SPECIFIC ELECTIVE COURSE -4 (DSE-4)
## VI.5.5. Computational Analysis of OMICS data

**CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE**

| Course title & Code | Credits | Credit distribution of the course | | | Eligibility criteria | Pre-requisite of the course (if any) |
|---|---|---|---|---|---|---|
| | | Lecture | Tutorial | Practical/ Practice | | |