

Course Title: Microarray and RNA Sequencing

Course Code CSE-895

Course Objectives:

Primary focus of the program under which the proposed course will be conducted is

- Basic understandings on how to analyze and interpret different transcriptomic data using high throughput technologies using R statistical language:
 - Understand the analysis of microarray data.
 - Understand the analysis of second-generation sequencing data at introductory level.
- Read/understand the current literature involving high dimensional Biology.
- Biological interpretation of data

Course Outcomes:

Students will be able to:

- Explore different methods for analysing gene expression data
- Incorporate machine learning techniques to cluster and classify gene expression data
- Assess optimisation-based algorithms for data clustering to enhance the accuracy of Disease classification.

Course Contents

- Introduction
 - Overview of Central Dogma of Molecular Biology
 - High density oligonucleotides
 - Spotted complementary cDNA technologies
 - High throughput genomic technologies
- Introduction to microarrays, data analysis and R programming
 - Microarray platforms
 - Affymetrix structure and function
 - File formats
 - Experimental designs
 - Data Analysis using Bio-conductor, R and Linux
 - Data pre-processing
 - Differential Expression
- Overview of statistical techniques and practical application using R and microarray data
 - Parametric (Pearson, t-test, one-way ANOVA)
 - Non-parametric (Spearman, Wilcoxon)
 - Multiple Comparison/FDR
- RNA Sequencing
 - Introduction to RNA-seq
 - RNA seq study design
 - RNA seq data analysis
- Biological Interpretation
 - Bioinformatics functional tools, gene annotation, databases

Recommended / Reference Books:

- DNA Microarray Analysis Using Bioconductor, JarnoTuimala CSC, the Finnish IT center for Science
- Statistics and Data Analysis for Microarrays Using R and Bioconductor Second Edition Sorin Draghici