ACEGID introduction to bioinformatics course outline. The following topics will be covered to help introduce the students and researchers to fundamentals of bioinformatics.

1. Introduction to Bioinformatics:

- Overview of bioinformatics and its applications in biology and medicine.

- Introduction to biological databases and data types (sequences, structures, gene expressions, etc.).

- Overview of key computational tools and resources in bioinformatics.

2. Biological Data Retrieval and Manipulation:

- Introduction to sequence data (DNA, RNA, protein) and file formats (FASTA, GenBank).

- Retrieving sequences from databases and local files.

- Sequence alignment algorithms and pairwise sequence alignment.

- Introduction to sequence databases (NCBI, UniProt) and their search tools.

3. Sequence Analysis:

- Multiple sequence alignment and its applications.

- Phylogenetic analysis and tree construction.

- Introduction to sequence similarity searching and basic BLAST usage.

- Introduction to sequence motif analysis and identification.

4. Structural Bioinformatics:

- Introduction to protein structure and its representation.

- Protein structure databases (PDB) and their tools.

- Homology modeling and structure prediction.

- Introduction to protein-ligand interactions and drug discovery.

5. Genomics and Transcriptomics:

- Introduction to genome sequencing and assembly.

- Annotation of genomes and gene prediction.

- Introduction to RNA sequencing (RNA-Seq) and data analysis.

- Gene expression analysis and differential expression.

6. Data Visualization and Analysis:

- Introduction to data visualization techniques in bioinformatics.

- Exploratory data analysis and statistical analysis.

- Introduction to R and its bioinformatics packages.

- Visualization and interpretation of biological networks and pathways.

7. Introduction to Machine Learning in Bioinformatics:

- Overview of machine learning techniques and their applications.

- Introduction to classification and regression in bioinformatics.

- Feature selection and dimensionality reduction.

- Hands-on exercises using machine learning tools in bioinformatics.

8. Practical Projects:

- Assign hands-on projects to apply the knowledge gained throughout the course.

- Provide real-world datasets and guide students in solving bioinformatics problems.

- Encourage students to explore additional topics of interest and present their findings.

9. Ethical and Legal Considerations:

- Discuss ethical considerations in bioinformatics research.

- Overview of data privacy, security, and intellectual property.

- Responsible conduct of research and publication ethics.

10. Emerging Trends in Bioinformatics:

- Introduce students to emerging areas like metagenomics, single-cell sequencing, and precision medicine.

- Discuss recent advances and future directions in bioinformatics research.

Remember to provide hands-on exercises, assignments, and practical projects throughout the course to reinforce learning. Additionally, encourage discussions, group activities, and guest lectures by experts in the field to provide a well-rounded learning experience.

Proposed tutorials

1. Genetic diversity: <https://introtogenomics.readthedocs.io/en/latest/2021_diversityTutorial.html>