BIOS 441/641: Practical Bioinformatics for Biologists
Fall 2016, SYLLUBUS

Class time: Tu/Th 11:00-12:15am

Classroom: MO444

Instructor: Dr. Yanbin Yin (yyin@niu.edu, MO325A)

Office hours: Tue/Thu/Fri 1-4pm (or email for appointment)

Website: http://cys.bios.niu.edu/yyin/teach/PBB/

Course description:

Bioinformatics is a relatively new discipline at the interface between biology and informatics. It evolved from biology (especially genetics/genomics), serves biology and is driven by biology. However the most fundamental methodologies in bioinformatics came from mathematics, statistics and computer science. Currently, bioinformatics education programs in the US Universities are mostly offered at graduate level and as interdisciplinary/interdepartmental programs with faculty from both biology and informatics sides. The research programs fall into two categories: (i) developing new bioinformatics algorithms/tools and (ii) using bioinformatics tools for biology/medicine/evolution researches.

This course, **Practical Bioinformatics for Biologists**, offered to biology students at both graduate and undergraduate levels, will focus on how to use existing bioinformatics tools. The department offers another two bioinformatics courses: (i) BIOS443/643 covering the theoretical basis of bioinformatics algorithms/tools and (ii) BIOS646 covering computer programing for bioinformatics. Our course BIOS441/641 features practical hands-on skills in using various bioinformatics softwares and web-based tools on Windows (no programming) and Linux computers (Unix bash programming). It emphasizes applications of computational tools to solve real biology problems. Students will work on eight homework assignments and two course projects as well as have a final exam. Homework will be assigned every two or three lectures.

Course goals:

- Learn various bioinformatics applications to analyzing DNA/RNA/protein sequence data.
- Applications include web-based databases/servers, Windows-based and Linux-based software packages with graphical user interface (GUI) and without GUI (command-line terminal).
- In order to use softwares on Linux machines, students will also learn how to work in a command-line environment without GUI, how to write simple shell one-liner scripts and more commonly how to run command-line bioinformatics tools.

Class rules:

- Attendance: students are required to attend all classes. Absences without notifying the instructor in advance will result in reduction in final grade.
- Cheating and Plagiarism: copying materials (figures, tables, sentences) directly from other people, literatures or internet without proper reference are considered as plagiarism and will lead to fail this class.

Grading:

Attendance: 5%

Home work (8 assignments): 40%

Projects: 30%

-Project 1: 15%, [use web-based tools]

-Project 2: 15%, [use command-line tools]

Final exam: 25%

Grading scales: A (>92%), A- (90-92%), B+ (87-89%), B (83-86%), B- (80-82%), C+ (77-79%), C (73-76%), C- (70-72%), D (60-69%), F (<60%)

Books:

Use my ppt slides (materials come from scientific journal publications and online training courses), but may refer to:

1. Practical Bioinformatics by Agostino, 2013 Garland Science
2. Practical Computing for Biologists by Haddock and Dunn, 2011 Sinauer
3. Developing Bioinformatics Computer Skills by Gibas and Jambeck, 2001 O'reilly

Schedule (subject to change):

Week	Topic	Material Download/Reading
Week 1	Course overview slides	Origin of Bioinformatics The roots of Bioinformatics Computational Biologists: The Next Pharma Scientists? An Explosion Of Bioinformatics Careers Bioinformatics: alive and kicking
	Basic molecular biology and overview of major bioinformatics web resources slides	EBI 2Can Nucleic Acids Research Annual Database Issue Nucleic Acids Research Annual WebServer Issue OBRC: Online Bioinformatics Resources Collection Oxford LibGuides Bioinformatics Databases & Web Resources UHK Bioinformatics Resources on the Web CCHMC Bioinformatics Resources bioinformaticsweb
Week 2-3	NCBI resources I: databases and Entrez slides NCBI resources II: web-based BLAST slides NCBI resources III: GEO, SRA and ftp resources slides	NCBI mcbios workshop NCBI web resource tutorials NCBI discovery workshops NCBI Help Manual NCBI tutorial on Youtube example mRNA file example protein file example gene list

		GEO Handout GEO NAR paper plant species list
Week 4-5	EBI resources I: UniProt and GO slides EBI resources II: InterPro, scop, superfamily slides EBI resources III: tools at EBI, ExPASy and DTU slides	EBI online training courses example id file example protein file slides InterPro training Ensembl tutorials Ensembl introduction ExPASy NAR paper FASTA guide example protein file example nucleotide file example alignment file example boxshade file
Week 6-7	Phylogeny and visualization: MEGA and iTOL slides	Molecular evolution and phylogenetic analysis Phylogeny for the faint of heart: a tutorial A step by step guide to phylogeny reconstruction Multiple sequence alignment accuracy and phylogenetic inference example color definition file example domain definition file newick format
Week 8	Go over project 1	Project 1
Week 9	Linux introduction slides Command line basics I: files and folders slides	youtube install ubuntu Unix chapter basics SIB Unix course EMBL Unix guide quick guide
Week 10	Linux command line basics II: downloading and controlling files slides	command line examples 1 command line examples 2 Useful Shell commands sed example awk example Shell one liner example
Week 11	Linux command line basics III: piping commands for text processing slides	
Week 12	Linux command line basics IV: install and run bioinformatics softwares on Linux slides	environment variable environment variable BLAST command line user manual emboss command line training
Week 13	Go over project 2	Project 2 Study guide for the final exam

Week 14	Holiday week (Happy Thanksgiving!)	
Week 15	Catch up time: finish projects	Project 2 Study guide for the final exam Unix one-liners for project 2 Venn diagram
Week 16	Final Exam on December 6th (11-12:30)	