EE260: Computational aspects of Integrative Biology

1) *Prerequisite*: Consent of instructor, background in imaging and machine learning
2) *Instructor: Bahram Parvin*
3) *Time and Location*: Friday, 12-3pm,
4) *Units*: 4
5) *Description*: The course introduces computational aspects of integrative biology for coupling high throughput experimental data. Instructor will provide a review of molecular and cell biology for Graduate students majoring in Electrical Engineering, Computer Science, or Bioengineering. The course will integrate advanced methods in biological image analysis with array-based data (such as gene expression and copy number data) for developing an improved synthesis of signaling networks.

6) *Course outline:*
    a. **Week 1**: review of cell and molecular biology for Engineers/Computer scientists and overview of the course projects
    b. **Week 2**: review of microscopy techniques, high content screening, and genomic technologies
    c. **Week 3**: Introduction to basic methods for analyzing microscopy and genomic data
    d. **Week 4**: Introduction to variational calculus and differential geometry
    e. **Week 5**: Variational approach image analysis (Part I)
    f. **Week 6**: Variational and graph cut methods for image analysis (Part II)
    g. **Week 7**: Voting methods for structural and functional analysis of images
    h. **Week 8**: Learning methods for phenotypic and genomic data: linear and non-linear methods (Part I)
    i. **Week 9**: Learning methods for phenotypic and genomic data: PCA, ICA, NMF and spectral methods (part II)
    j. **Week 10**: Reverse engineering of signaling networks
    k. **Week 11**: Project presentation
7) *References*: Instructor will provide papers and handouts. Other references are:
    a. Andres Kriete (editted), “Systems Biology,” Elsevier, 2005,
    b. Bruce Alberts, et al, “Molecular Biology of the Cell,” 4th edition, Garland Publitioning, Inc.
    c. Neapolitan, R. “Learing Bayesian Networks”, Prentice Hall Series, 2004
    d. Weinberg, R., “The Biology of Cancer”
8) *Grading:* project presentation and final report
9) *Quarter*: Fall 2009