

## COLLEGE OF ENGINEERING

### SUMMER RESEARCH OPPORTUNITIES FOR UNDERGRADUATE WOMEN

**APPLICATION DEADLINE: March 1, 2007**

*The Department of Mechanical, Industrial and Nuclear Engineering is pleased to offer the following research project for the summer of 2007. Interested students are urged to contact the faculty member(s) directing the project that most interests them. By contacting the faculty member, you can discover more about the project, learn what your responsibilities will be and if possible, develop a timetable for the twelve-week research period.*

#### **Condition Monitoring for Evidence-based Care of Psychiatric Patients**

**Dr. Samuel H. Huang**

Department of Mechanical, Industrial and Nuclear Engineering

University of Cincinnati

Cincinnati, OH 45221

E-mail: [sam.huang@uc.edu](mailto:sam.huang@uc.edu)

Phone: 513-556-1154

#### **Project Description**

To optimize patient recovery in today's world of higher drug costs and shorter hospital stays, physicians are moving towards evidence-based patient care which promotes the collection, interpretation, and integration of applicable patient-reported, clinician-observed, and research-derived evidence to improve the quality of clinical judgments and facilitate cost-effective healthcare. This is an admirable but currently illusive goal because mature supporting technologies are lacking. The philosophy of evidence-based patient care is similar to that of condition-based maintenance (CBM) in manufacturing, which advocates the monitoring of production equipment using various sensors to enable real-time diagnosis of impending failures so the right maintenance actions can take place in a timely fashion and on an as-needed basis. CBM research is relatively mature and the knowledge generated, namely, diagnosis/prognosis modeling (i.e., techniques for mining and interpreting sensor data), is applicable to patient care.

The goal of this project is to adapt condition monitoring technology for evidence-based care of psychiatric patients. The focus on psychiatric patients is due to the high cost of psychotropic medication and pressing questions regarding the safety of antidepressant drugs. The challenges for this technology adaptation are mainly due to the nature of patient data; namely, large number of parameters and gaps (missing values) in the data. In a Medicare Health Outcomes dataset we obtained from the Centers for Medicare & Medicaid Services (CMS), there are 102 parameters. Some of the parameters may or may not have a causal relationship with patient health. In this dataset, only 0.76% (1343 out of 177,760) of the samples is complete (no missing values in any of the 102 parameters). The average amount of missing values is 9.00%, with some parameters having as much as 85.02% missing values. As such, the dimensionality

of these datasets must be reduced and the missing value problem must be resolved so methods developed in CBM research can be effectively applied.

We are seeking one or two undergraduate students to work with our research team (Dr. Sam Huang from the College of Engineering, Dr. Lawson Wulsin from the College of Medicine and graduate students from the College of Engineering and College of Pharmacy) to identify existing dimensionality reduction and missing data imputation techniques and apply these techniques to real-world medical datasets. This project is supported by the National Science Foundation, which pays a stipend of approximately \$10 per hour for undergraduate students. Work hour is flexible and can be arranged based on the student's convenience.