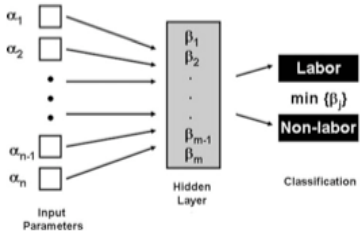
Identification of Human Term and Preterm labor using Uterine Electromyography

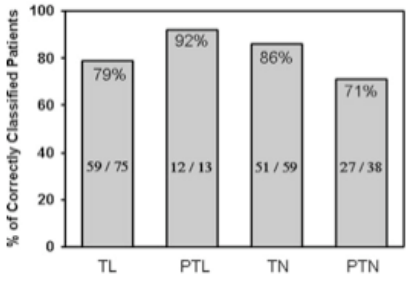
Jenna Marcus
Biomedical Engineering Seminar III
April 16, 2007

Preterm labor is an urgent challenge in current healthcare. Many handicaps and 85% of perinatal deaths are a because of preterm birth. 10% of births each year are preterm with birth-weights of less than 5.5 lbs. Complications of preterm birth include neurological, mental, behavioral, and pulmonary problems. In survivors of preterm birth, neurological impairment varies from 10% to 20% and growth is restricted 20%. The ability to identify preterm labor is crucial in the survival of an infant born prematurely. The first step in the identification of preterm labor is to know how to recognize false labor from true labor. There are a few primary differences that help to determine this. In true labor: contractions are four to six minutes apart and last approximately thirty to seventy seconds; contractions strengthen over time, rarely weakening; the pain moves from the back to the front; and despite a change in position or fluid intake, contractions will continue to occur. In false labor: contractions are irregular and do not become closer; they usually do not strengthen overtime; the pain is felt in the front area only; and a change in position or intake of water may stop or slow contractions. Electromyography (EMG) is a way to monitor the electrical activity in a muscle or groups of muscles. In the case of a pregnant woman, uterine contractility used to be monitored by placing electrodes directly on the uterus. Most recently, the same results are trying to be obtained using noninvasive procedures. The electrodes are placed directly on the abdominal surface. The data, once obtained, must be analyzed to obtain a diagnostic result. To analyze the data, Artificial Neural Networks (ANNs) are used. ANNs "are ideal for the classification of objects (e.g., patients) based upon one or more input variables (e.g., uterine EMG variables)" (Maner 466).



ANN MODEL

An ANN is made up of a circuit or computer program (equivalent of neurons in the brain of living creatures) that has three main parts. The three parts are the inputs, the "hidden layers" to process the data, and the outputs. In the case of the uterine electromyography, the inputs are multiple parameters calculated using statistical analysis. The outputs will classify if a woman is going through labor, preterm labor, non-labor, or preterm non-labor. Using the data obtained from the uterine EMG along with ANNs, labor is more easily assessed.
The results of the data show that using ANNs along with uterine EMG information, the identification of labor stages can be more accurately assessed. The percentage of correctly identified patients was high for all groups. This table shows the capability of ANNs to identify labor. With the use of Artificial Neural Networks in conjunction with EMG data, it is easier to identify patients who are in labor versus those who are not. Hopefully, with this new technology, the amount of preterm births will decrease and woman will spend less unnecessary time in the hospital assessing labor.



RESULTS

TL = Term Labor
TN = Term Non-labor
PTL = Pre-term Labor
PTN = Pre-term Non-labor

References:

- http://www.ucihealth.com/maternity/aTrueVSFalseLabor.htm
- Maner, William L. and Robert E. Garfield. "Identification of Human Term and Preterm Labor using Artificial Neural Networks on Uterine Electromyography Data." Annals of Biomedical Engineering. 35 (2007): 465-473.