生醫訊號分析理論與實務

時間：100 年 12 月 3 日(六)　08:30 - 17:30

地點：馬偕醫護管理專科學校 關渡校區綜合教學大樓

講題摘要

議題一：利用經驗模態分解於超音波的早期肝纖維化偵測

工業技術研究院生醫所 包舜華博士

國人十大死亡原因中，慢性肝病與肝硬化名列在前，由此可見肝病對國人健康之威脅甚為嚴重。肝穿刺檢驗是臨床上評估肝纖維化程度的黃金標準，但是肝穿刺檢驗有術後併發症的風險。因此發展一套簡單、可靠且具有非侵入性的方式來評估患者肝纖維化程度在臨床上是有其必要性。

診斷用途的超音波具有非侵入式、低成本、可重複量測等優點，是一種常用於臨床上的診斷工具。超音波雖有其臨床價值，但是使用的設定與後續的影像處理均會顯著地影響最後評估結果。原本研究著重於量化超音波影像對於肝臟纖維化程度，但是在處理過程中發現超音波影像的標準化才是最主要的關鍵。為此希望在在這個講演主題，透過超音波成像的物理學，探討診斷流程的超音波影像如何標準化。這些標準化的過程有些來至於超音波儀器必須的預設，以及使用新一代的影像處理技術來獲得夠有臨床價值的訊息。

議題二：現代訊號分析於神經重症病患之應用

國泰醫院神經外科 蘇亦昌醫師

In modern critical care units, multi-modality monitorings are usually mandatory in the aid of clinical judgment. Bio-signals directly retrieved from patients, such as electrocardiography, arterial blood pressure, and intracranial pressure, have already been proved to be of great value in clinical practice. Indices derived from those conventional signals, such as cardiac outputs calculated from arterial blood pressure and autonomic nervous activities calculated from heart rate variabilities, can further generate important physiological parameters which cannot be measured traditionally at bedside. Based on this concept, researchers are eager to develop promising and clinically valuable indices using newly-proposed algorithms. This has become one of current mainstreams in the field of modern bio-signal processing. In this presentation, we'll share with you how new ideas can be generated from a clinician's point-of-view, and also introduce you several examples of applications using modern bio-signal indices in neurocritical care.

議題三：腦波訊號分析與神經工程

國立成功大學資工與醫學資訊所 梁勝富教授

經過幾十年的腦波研究，各種年齡層的腦波差異、不同睡眠階段的腦波特徵、乃至各種腦病變所呈現腦波特性都逐漸被發現。在跨領域高度整合為趨勢的現在，將資訊技術應用於生物醫學相關應用已相當普遍。本演講將講解腦波基本特性及各種分析方法，並介紹腦波分析在神經工程方面的實際應用，如腦機介面與反應式深部顱內電刺激器等，皆需要即時感測與分析腦波訊號，並整合電子與資訊技術，讓學員瞭解腦波基礎知識及其最新發展趨勢。

議題四：Introduction to Medical Signal Analysis

逸奇科技股份有限公司總經理 王逸民博士

1. Fourier analysis
2. Time-frequency analysis
3. Multi-scale Entropy
4. Independent Component Analysis
5. Detrended fluctuation Analysis and Hurst Exponent
6. Power Law

議題五：Design a Force Platform for Measuring Center of Pressure (COP) Signal

元智大學機械工程系 謝建興教授

Speaker: Prof. Jiann-Shing Shieh
Department of Mechanical Engineering, Yuan Ze University, Taiwan

"Falling" is an unpredictable accident and the caused damage is a great worry to be concerned. In recent years, the proportion of the elderly population is getting higher in Taiwan, which shows that Taiwan has stepped into the aging society. In this situation, the elderly medical care ratio increased gradually included the fall accident care. Referring the correlated studies, center of pressure (COP) is an important measurement used for quantifying the dynamic property of human's balance. It can be used to assess the risk of falling among elderly people.

The aim of this study is to design a low cost and portable measuring device of COP for data collecting and analysis, which is called center of pressure and complexity monitoring system (CPCMS). Firstly, we presented details about design concepts, functions of measurement component, and signal analysis of multi-scale entropy algorithm. In order to verify the reproducibility of the measurement system, we conducted a series of experiments, including static and dynamic tests. Secondly, in order to prove that our system can estimate the different sizes of the different sways, we designed four sway tests to produce different sway displacement. We use traditional and multi-scale entropy analysis methods to analyze the COP signal

received by CPCMS and compare with the commercial product of Advanced Mechanical Technology Incorporation (AMTI) system. The results indicated that CPCMS can receive the same results with the AMTI system in comparison with these four sway tests under the statistical analysis. In conclusion, a low cost and portable system (i.e., CPCMS) for measuring and analysis COP signal has been designed in this paper which is allowed us to quantify the dynamic property of human's balance in order to assess the risk of falling among elderly people via large population size more handy and conveniently in the near future.

Keywords: Falling, noninvasive physiological signs, center of pressure, multi-scale entropy.

Brief biography:

Jiann-Shing Shieh, Ph.D. is a Professor of Department of Mechanical Engineering, a joint Professor of Graduate School of Biotechnology and Bioengineering, and also serves as head of department of mechanical engineering of Yuan Ze University in Taiwan. His research interests are focused on biomedical engineering, particularly in bio-signal processing, intelligent analysis and control, medical automation, pain model and control, critical care medicine monitoring and control, dynamic cerebral autoregulation research, and brain death index research. Prof. Shieh's recent research involved in bio-signal (e.g., ECG, BP, EEG, SPO2, center of pressure (COP) position) analysis, especially in using multi-scale entropy (MSE) and Hilbert-Huang Transform (HHT) in gerontechnology.

議題六：A Noninvasive Measurement of ANS

台安醫院婦產科 廖文劍醫師

Objective: A connection between Idiopathic overactive bladder syndrome and specific autonomic nervous system (ANS) dysfunction in women has been proposed. To verify this hypothesis we have measured ANS dysfunction using ECG heart rate variability in 33 OAB and 176 normal cases. Methods: Heart Rate Variability (HRV) data was obtained by ECG recording of 33 female patients with OAB for 15 minute periods around episodes of urinary urgency Results were compared to data from 176 healthy, age-matched subjects. HRV data was statistically analyzed to quantify and display ANS activity, including power spectrum density (PSD), 3D-spectrograms, and neuron entropy graphs. Results: Differences in HRV were observed between OAB and normal patients, suggesting variations in ANS activity. These variations included time and frequency parameters. All variations were statistically significant ($P<0.05$), were quantified by calculating the PSD and easily visualized by using 3D-spectrograms and multiscale entropy graphs. Conclusion: This study shows that HRV provides a simple, non-invasive method to evaluate the differences in the ANS of OAB patients. HRV can be used to supplement current methods of diagnosing OAB and monitoring its treatment, by using measurable, quantitative data. The principles of HRV statistical analysis can also be expanded to evaluate other neuronal diseases.