

# 羅孟宗 Men-Tzung Lo

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## BIOGRAPHY

Men-Tzung Lo, Ph.D., is Associate Research Scientist of Center for Adaptive Data Analysis, National Central University. Dr. Lo obtained his Ph.D. in Communication Engineering from National Taiwan University for his works on biomedical signal and image processing as well as biomedical imaging and drug delivery system. He also helped to develop reliable QRS analysis algorithms for FDA approved commercial ECG recorder. After that, he acquired his post-doctoral training in Taipei Veteran General Hospital and Syncope and Falls in the Elderly (SAFE) Laboratory at Beth Israel Deaconess Medical Center for applying novel nonlinear signal analysis to multiple biomedical signals from different disease groups to explore their underlying properties and quantifying the properties altered from normal as parameters for severity or prognosis of diseases. His two main research interests are time varying interactions between multiple biological signals of human subjects and the changes of nonlinear properties in different physiological and pathological statuses. In addition to papers in physics or engineering fields, he published number of papers with clinicians for wide ranges of clinical topics.

羅孟宗博士現職為國立中央大學數據分析方法研究中心副研究員。其以生物醫學訊號、影像處理以及生物醫學影像和給藥系統相關研究獲得國立臺灣大學電信工程研究所博士學位，期間並協助開發可靠的 QRS 波分析演算法供 FDA 核准上市之心電圖記錄儀之用。之後分別在臺北榮民總醫院以及貝斯以色列女執事醫療中心的老年人暈厥和跌倒 (SAFE) 實驗室擔任博士後研究員，藉由在不同的疾病分組上應用多種生物醫學信號的嶄新非線性信號分析方法，探索其內在特性，並量化這些特性由正常至疾病的變化，作為嚴重程度或疾病預後評估的參數。其主要研究方向有二：一是多個人類受試者的生物信號隨時間變化的交互作用；另一是在不同的生理和病理狀態之間非線性特性的變化。除物理及工程領域外，亦與臨床醫師針對各種臨床課題共同發表多篇論文。

## EDUCATION

### 1999–2004 Ph.D. Degree

- Graduate Institute of Communication Engineering of National Taiwan University, Taipei
- Major in biomedical signal and image processing, biomedical imaging and drug delivery system.

### 1997–1999 Master Degree

- Graduate Institute of Communication Engineering of National Taiwan University, Taipei
- Major in communication engineering, digital signal processing, and blood flow estimation using ultrasound signals.

### **1993–1997 Bachelor Degree**

- Electrical Engineering of National Cheng-Kung University, Tainan
- Major in Electrical Engineering.

### **RESEARCH SPECIALTY (IN GRADUATE SCHOOL)**

- Bio-signal and image processing
- Bio-signal and image analysis
- Diagnostic medical ultrasound system
- Linear and non-linear signal processing
- Communication system

### **REVIEWERS**

- Advances in Adaptive Data Analysis
- American Journal of Physiology- Heart and Circulatory Physiology
- Biomedical Engineering: Application, Basis and Communication
- BioMedical Engineering OnLine
- Computer Methods and Programs in Biomedicine
- Computer Physics Communications
- IEEE Transactions on Ultrasonics, Ferroelectrics and Frequency Control
- IEEE Transactions on Circuits and Systems II
- IEEE Transactions on Information Technology in BioMedicine
- Journal of Theoretical Biology
- Journal of Medical and Biological Engineering
- Journal of Neuroscience Methods
- Neuroscience Letters
- Physica A: Statistical Mechanics and its Applications
- PLOS ONE
- Sensors
- Soil Dynamics and Earthquake Engineering
- Reviewer for NSC project, Taiwan , ROC

### **EMPLOYMENT**

2013(July.)–now **Visiting Associate Professor of Medicine**  
 • Medicine-Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA

2011(Aug.)–now **Associate Research Scientist**  
 • Research Center for Data Analysis, National Central University, Chungli, Taiwan

2007 (Aug.)–2011(Jul.) **Assistant Research Scientist**  
 • Research Center for Data Analysis, National Central University, Chungli, Taiwan

2007 (Feb.)–2007(Jun.) **Postdoctoral Researcher**

- Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, USA

2006 (June)–2007(Feb.) **Postdoctoral Researcher**

- Department of Anesthesiology, Taipei Veterans General Hospital, Taipei, Taiwan

2005–2006 (Jun.) **Information Officer**

- Military service in the Army

2003 – 2005 **Senior Engineer**

- Research Center of Micro-Star International Company

## AWARDS

2012 Outstanding Research Award of National Central University

## PUBLICATION

***Journal Paper*** ( # equally first; \* corresponding author)

1. T-C Tuan#, ***M-T Lo***#, Y-J Lin, W-H Hsieh, C Lin, N E Huang, L-W Lo, T-F Chao, J Liao, Y-C Hsieh, T-J Wu; S-A Chen, "The Use of Signal Analyses of Ventricular Tachycardia Electrograms to Predict the Response of Anti-tachycardia Pacing in Patients with Implantable Cardioverter-defibrillators", " ***Journal of Cardiovascular Electrophysiology***, Accept, 2013 Dec (# equally first)(SCI) (IF: 3.5, Rank: 34/122)
2. A C. Yang, C-C Huang, M-E Liu, Y-J Liou, C-J Hong, ***M-T Lo***, N E. Huang, C-K Peng, C-P Lin, S-J Tsai, "The APOE  $\epsilon$ 4 allele affects complexity and functional connectivity of resting brain activity in healthy adults", ***Human Brain Mapping*** (2013 Nov.)(IF: 6.8, Rank: 1/12)
3. J-R Yeh, C-K Peng, ***M-T Lo***\*, C-H Yeh, S-C, Chen, C-Y, Wang, P-L Lee, J-H Kang, Investigating the interaction between heart rate variability and sleep EEG using nonlinear algorithms, ***Journal of Neuroscience Methods***, Vol 219, Issue 2, pp 233-239, 2013 Oct. (\* corresponding author) (SCI) (IF: 1.98, Rank: 48/72)
4. Albert C. Yanga, S-J Wangd, K-L Laie, C-F Tsai, C-H Yang, J-P Hwang, ***M-T Lo***, Norden E. Huangc, C-K Peng, J-L Fuh, "Cognitive and neuropsychiatric correlates of EEG dynamic complexity in patients with Alzheimer's disease." ***Progress in Neuro-Psychopharmacology and Biological Psychiatry*** Volume 47, 2 December 2013 Dec, Pages 52–61 (IF: 3.5, Rank: 31/135)
5. Y-J Lin#, ***M-T Lo***#, C Lin, S-L Chang, L-W Lo, Y-F Hu, W-H Hsieh, H-Y Chang, W-Y Lin, B Hartono, D Hanafy, H-M Tsao, N E. Huang, S-A Chen, " Prevalence, Characteristics, Mapping, and Catheter Ablation of Potential Rotors in Nonparoxysmal Atrial Fibrillation ", ***Circulation: Arrhythmia Electrophysiology***, 2013; 6: 851-858 (# equally first) (SCI) (IF: 6.4, Rank: 16/117)
6. ***M-T Lo***, L-Y Lin, W-H Hsieh, P C-I Ko, Y-B Liu, C Lin, Y-C Chang, C-Y Wang; V H-W Young, W-C Chiang; J-L Lin, W-J Chen, M H-M Ma, " A New Method to Estimate the Amplitude Spectrum Analysis of Ventricular Fibrillation During Cardiopulmonary Resuscitation" ***Resuscitation***, Volume 84, Issue 11, November 2013, Pages 1505–1511 (SCI)(IF=4.1,2/24)

7. H.-T. Wu, C.-C. Liu, **M.-T. Lo**, P.-C. Hsu, A.-B. Liu, K.-Y. Chang, C.-J. Tang, "Multiscale Cross-Approximate Entropy Analysis as a Measure of Complexity among the Aged and Diabetic," *Computational and Mathematical Methods in Medicine*, 2013. Volume 2013, Article ID 324325, (SCI) (IF=0.791, 40/47)
8. H.-C. Chang, P.-L. Lee, M.-T. Lo, Y.-T. Wu, K.-W. Wang, and G.-Y. Lan, "Inter-Trial Analysis of Post-Movement Beta Activities in EEG Signals Using Multivariate Empirical Mode Decomposition," *IEEE Trans Neural Syst Rehabil Eng*, 2013 Jul;21(4):607-15. (SCI) (IF=3.25, 3/63)
9. Y.-C. Liu, C.-S. Hung, Y.-W. Wu, Y.-C. Lee, Y.-H. Lin, C. Lin, **M.-T. Lo**, C.-C. Chan, H.-P. Ma, Y.-L. Ho, C.-H. Chen, "Influence of Non-Alcoholic Fatty Liver Disease on Autonomic Changes Evaluated by the Time Domain, Frequency Domain, and Symbolic Dynamics of Heart Rate Variability," *PLoS one*, 2013, 8.4: e61803. (SCI)
10. H.-T. Wu, P.-C. Hsu, C.-K. Sun, A.-B. Liu, Z.-L. Lin, C.-J. Tang, **M.-T. Lo**\* "Assessing Vascular Endothelial Function Using Frequency and Rank Order Statistics," *Physica A: Statistical Mechanics and its Applications*, Volume 392, Issue 15, 1 August 2013, Pages 3122–3131. (\* corresponding author) (SCI) (IF=1.67,28/83)
11. H.-T. Wu, P.-C. Hsu, C.-K. Sun, H.-J. Wang, C.-C. Liu, H.-R. Chen, A.-B. Liu, C.-J. Tang, **M.-T. Lo**\*, "Assessment of Autonomic Dysfunction in Patients with Type 2 Diabetes Using Reactive Hyperemia," *Journal of Theoretical Biology*, 2013 Aug 7;330:9-17. (\* corresponding author) (SCI) (22/83) (IF=2.351)
12. H.-T. Wu, **M.-T. Lo**, G.-H. Chen, C.-K. Sun and J.-J. Chen, "Novel application of a multiscale entropy index as a sensitive tool for detecting subtle vascular abnormalities in the aged and diabetic," *Computational and Mathematical Methods in Medicine*, Volume 2013, Article ID 645702. (SCI) (40/47) (IF=0.791)
13. Y.-J. Lin, **M.-T. Lo**#, C. Lin, S.-L. Chang, L.-W. Lo, Y.-F. Hu, T.-F. Chao, C.-H. Li, Y.-C. Chang, W.-H. Hsieh, F.-P. Chang, H.-T. Tsao, H.-Y. Chang, N.-E. Huang, and S.-A. Chen, "Nonlinear Analysis of Fibrillatory Electrograms Similarity to Optimize the Detection of Complex Fractionated Electrograms During Persistent Atrial Fibrillation," *Journal of Cardiovascular Electrophysiology*, 2013 May;24(3):280-9,2013 (# equally first)(SCI) (IF: 3.5, Rank: 34/122)
14. C.-H. Wu, P.-L. Lee, C.-H. Shu, C.-Y. Yang, **M.-T. Lo**, C.-Y. Chang, and J.-C. Hsieh, "Empirical Mode Decomposition-Based Approach for Intertrial Analysis of Olfactory Event-Related Potential Features," *Chemosensory Perception*, 12 Sep. 2012, DOI: 10.1007/s12078-012-9134-8 (SCI) (IF: 1.64, Rank: 45/128)
15. M.-C. Aoi, K. Hu, **M.-T. Lo**, M. Selim, M.-S. Olufsen, and V. Novak, "Impaired Cerebral Autoregulation Is Associated with Brain Atrophy and Worse Functional Status in Chronic Ischemic Stroke," *PLoS One*, (Epub 2012 Oct. 11.) (SCI)(IF: 4.351, Rank: 12/86)
16. Y.-J. Lin, K. Suenari, **M.-T. Lo**, C. Lin, W.-H. Hsieh, S.-L. Chang, L.-W. Lo, Y.-F. Hu, C.-C. Cheng, W.-S. Lin, Y. Kihara, T.-F. Chao, B. Hartono, T.-J. Wu, N.-E. Huang, and S.-A. Chen, "A Novel Assessment of the Temporal Variation in the Fractionated Electrograms Using a Histogram Analysis of the Local Fractionation Interval in Persistent Atrial Fibrillation Patients," *Circulation: Arrhythmia Electrophysiology*, 25 Jul. 2012 (SCI) (IF: 6.4, Rank: 16/117)
17. P.-H. Tsai, C. Lin, J. Tsao, P.-F. Lin, P.-C. Wang, N.-E. Huang, and **M.-T. Lo**\*

- "Empirical Mode Decomposition Based Detrended Sample Entropy in Electroencephalography for Alzheimer's Disease," *Journal of Neuroscience Methods*, 31 Jul. 2012; 210(2): 230–237 (\* corresponding author) (SCI) (IF: **1.98**, Rank: **48/72**)
18. Y.-H. Lin, X.-M. Wu, H.-H. Lee, J.-K. Lee, Y.-C. Liu, H.-W. Chang, C.-Y. Lin, V.-C. Wu, S.-C. Chueh, L.-C. Lin, **M.-T. Lo**, Y.-L. Ho, K.-D. Wu, and the TAIPAI Study Group, "Adrenalectomy Reverses Myocardial Fibrosis in Patients with Primary Aldosteronism," *Journal of Hypertension*, 30 Aug. 2012 (8): 1606–1613. (SCI) (IF:**4.02** ,Rank:**12/68**)
  19. K. Hu, **M.T. Lo\***, C.K. Peng, Y. Liu, and V. Novak, "A Nonlinear Dynamic Approach Reveals a Long-Term Stroke Effect on Cerebral Blood Flow Regulation at Multiple Time Scales," *PLoS Computational Biology*, 8(7): e1002601, doi: 10.1371/journal.pcbi.1002601 2012 (\* corresponding author) (SCI) (IF: **5.515**, Rank: **1/37**)
  20. X.-M. Wu, Y.-H. Lin, A. Chen, T.-P. Hsu, Y.-W. Wu, H.-J. Lin, R.-B. Hsu, C.-M. Lee, S.-S. Wang, **M.-T. Lo**, Y.-L. Ho, and M.-F. Chen, "Prognostic Significance of Adipocytokines in Systolic Heart Failure Patients," *European Journal of Clinical Investigation*, doi: 10.1111/j.1365-2362.2012.02698.x 2012 (SCI) (IF: **3.018**, Rank: **21/153**)
  21. Y.-H. Lin, L.-Y. Lin, A. Chen, X.-M. Wu, J.-K. Lee, T.-C. Su, V.-C. Wu, S.-C. Chueh, W.-C. Lin, **M.-T. Lo**, P.-C. Wang, Y.-L. Ho, and K.-D. Wu, "Adrenalectomy Improves Increased Carotid Intima-Media Thickness and Arterial Stiffness in Patients with Aldosterone Producing Adenoma," *Atherosclerosis*, Volume 221, Issue 1, March 2012, Pages 154–159 (SCI) (IF: **4.15**, Rank: **12/68**)
  22. C.-H. Chang, P.-L. Lee, **M.-T. Lo**, I.-H. Lee, T. K. Yeh, and C.-Y. Chang, "Independence of Amplitude–Frequency and Phase Calibrations in an SSVEP-Based BCI Using Stepping Delay Flickering Sequences," *IEEE Transactions on Neural System & Rehabilitation Engineering*, Volume 20, Issue 3, May 2012, Pages 305–312 (SCI) (IF: **3.436**, Rank: **4/58**)
  23. L.-Y. Lin#, **M.-T. Lo#**, P. C.-I. Ko, W.-C. Chiang, C. Lin, K.-H. Hsiung, J.-L. Lin, W.-J. Chen, and M. H.-M. Ma, "A New Way to Analyze Resuscitation Quality by Reviewing Automatic External Defibrillator Data," *Resuscitation*, Volume 83, Issue 2, Feb. 2012, Pages 171–176 (# equally first) (SCI) (IF: **4.3**, Rank: **1/23**)
  24. P.-J. Pan, P.-H. Tsai, C.-C. Tsai, C.-L. Chou, **M.-T. Lo**, and J.-H. Chiu, "Clinical Response and Autonomic Modulation as Seen in Heart Rate Variability in Mechanical Intermittent Cervical Traction: A Pilot Study," *Journal of Rehabilitation Medicine*, Volume 44, No. 3, March 2012, Pages 229–234(6) (SCI) (IF: **2.4**, Rank: **12/44**)
  25. N. E. Huang, X.-Y. Chen, **M.-T. Lo**, and Z.-H. Wu, "On Hilbert Spectral Representation: A True Time–Frequency Representation For Nonlinear And Nonstationary Data," *Advances in Adaptive Data Analysis*, Volume 3, No. 1–2, Pages 63–93, 2011
  26. H.-T. Wu, P.-C. Hsu, C.-F. Lin, H.-J. Wang, C.-K. Sun, A.-B. Liu, **M.-T. Lo**, and C.-J. Tang, "Multiscale Entropy Analysis of Pulse Wave Velocity for Assessing Atherosclerosis in the Aged and Diabetic," *IEEE Transactions on Biomedical Engineering*, Volume 58, No. 10, Pages 2978–2981, 2011 (IF: **2.347**, Rank: **32/70**)

27. Y.-L. Ho, C. Lin, Y.-H. Lin, and **M.-T. Lo\***, "The Prognostic Value of Nonlinear Analysis of Heart Rate Variability in Patients with Congestive Heart Failure—A Pilot Study of Multiscale Entropy," *PLoS One*, Volume 6, No. 4, Pages e18699, 2011. (\* corresponding author) (SCI) (IF: **4.351**, Rank: **12/86**)
28. Y.-W. Chiu, **M.-T. Lo#**, M.-R. Tsai, Y.-C. Chang, R.-B. Hsu, H.-Y. Yu, C.-K. Sun, and Y.-L. Ho, "Applying Harmonic Optical Microscopy for Spatial Alignment of Atrial Collagen Fibers," *PLoS One*, Volume 5, No. 11, Pages e13917, 2010. (# equally first) (SCI) (IF: **4.351**, Rank: **12/86**)
29. H.-K. Yuan, C. Lin, P.-H. Tsai, F.-C. Chang, K.-P. Lin, H.-H. Hu, M.-C. Su and **M.-T. Lo\***, "Acute Increase of Complexity in the Neurocardiovascular Dynamics Following Carotid Stenting," *Acta Neurol Scand*, DOI: 10.1111/j.1600-0404.2010.01384.x., 2010 (\* corresponding author ) (SCI) (IF: **2.304**, rank: **78/167**)
30. Y.-H. Lin, C. Lin, **M.-T. Lo\***, H.-J. Lin, Y.-W. Wu, R.-B. Hsu, C.-L. Chao, H.-C. Hsu, P.-C. Wang, V.-C. Wu, S.-S. Wang, C.-M. Lee, K.-L. Chien, Y.-L. Ho, M.-F. Chen, and C.-K. Peng, "The Relation Between Aminoterminal Propeptide of Type III Procollagen and Heart Rate Variability Parameters in Heart Failure Patients: a Potential Serum Marker to Evaluate Cardiac Autonomic Control and Sudden Cardiac Death," *Clin. Chem. Lab. Med.*, Dec.; 48(12): 1821–7, 2010 (\* corresponding author) (SCI) (IF: **1.886**, Rank: **10/29**)
31. L.-Y. Lin, **M.-T. Lo**, P. C.-I. Ko, C. Lin, W.-C. Chiang, Y.-B. Liu, M. H.-M. Ma, J.-L. Lin and W.-J. Chen, "Detrended Fluctuation Analysis Predicts Successful Defibrillation for Out-of-Hospital Ventricular Fibrillation Cardiac Arrest," *Resuscitation*, Volume 81, No. 3, Pages 297–301, 2010 (SCI) (IF: **4.3**, Rank: **1/23**)
32. M. R. Tsai, Y. W. Chiu, **M.-T. Lo**, and C. K. Sun, "Second-Harmonic Generation Imaging of Collagen Fibers in Myocardium for Atrial Fibrillation Diagnosis," *Journal of Biomedical Optics*, Volume 15, No. 2, Mar. 2010 (SCI) (IF: **2.501**, Rank: **9/71**)
33. K. Hu, **M.-T. Lo**, C.-K. Peng, V. Novak, E. A. Schmidt, A. Kumar, and M. Czosnyka, "Nonlinear Pressure-Flow Relationship Is Able to Detect Asymmetry of Brain Blood Circulation Associated with Midline Shift," *Journal of Neurotrauma*, Volume 26, No. 2, Pages 227–233, Feb. 2009 (SCI) (IF: **4.255**, Rank: **22/167**)
34. **M.-T. Lo**, V. Novak, C.-K. Peng, Y.-H. Liu, and K. Hu, "Nonlinear Phase Interaction Between Nonstationary Signals: A Comparison Study of Methods Based on Hilbert–Huang and Fourier Transforms," *Physical Review e*, Volume 79, No. 6, Jun. 2009 (SCI) (IF: **2.4**, rank: **4/54**)
35. **M.-T. Lo**, P.-H. Tsai, P.-F. Lin, C. Lin, and Y.-L. Hsin, "The Nonlinear and Nonstationary Prosperities in EEG Signals: Probing the Complex Fluctuations by Hilbert–Huang Transform," *Advances in Adaptive Data Analysis*, Volume 1, No. 3 Pages 461–482, 2009
36. **M.-T. Lo**, K. Hu, Y.-H. Liu, C.-K. Peng, and V. Novak, "Multimodal Pressure–Flow Analysis: Application of Hilbert–Huang Transform in Cerebral Blood Flow Regulation," *EURASIP Journal on Advances in Signal Processing*, 2008: 785243. (SCI) (IF: **0.885**, Rank: **132/246**)
37. C.-Y. Wu, **M.-T. Lo**, J. Tsao, A. Chu, Y.-H. Chou, and C.-M. Tiu, "Factor Analysis in Both Spatial and Temporal Domains of Color Blooming Artifacts in Ultrasound

Investigations Utilizing Contrast Agents," *Computerized Medical Imaging and Graphics* 2004, pp. 129-140. (SCI)

38. **M.-T. Lo**, J. Tsao, and D.-R. Su, "Volume Scattering of Distributed Microbubbles and Its Influence on Blood Flow Estimation," *IEEE Transactions on Ultrasonics, Ferroelectrics and Frequency Control*, Volume: 50, Issue: 12, Dec. 2003, pp. 1699-1710. (SCI)

### Patent

U.S

- **M-T Lo**, L-Y Lin, P. C-I Ko, C. Lin, M. H.-M Ma; "System and method for predicting successful defibrillation for ventricular fibrillation cardiac arrest" US, #8,380,305
- **M-T Lo** and Y. Liu, "Systems and methods for assessing dynamic cerebral autoregulation", US, #8,211,022
- **M-T Lo** and Y. Liu, "Accurate detection of sleep-distorted breathing", US, # **8103,483**
- C.-Y. Wu, Y.-H. Chou, T.-J. Su and **M-T Lo**; "Method and related system for measuring intracranial pressure", **US, #7682310**

### INVITED SPEAK

- The 6rd Asia Pacific Heart Rhythm Society Scientific Session, 2013
- National Tsing Hua University Department of Electrical Engineering, 2013
- National Central University Graduate Institute of Biomedical Engineering, 2013
- The 5rd Taiwan Society of Critical Care Medicine, 2012
- The 5rd Asia Pacific Heart Rhythm Society Scientific Session, 2012
- The 3rd Asian Epilepsy Surgery Congress, 2010
- National Taiwan University Hospital Department of Traumatology
- Shin Kong Wu Ho-Su Memorial Hospital Sleep Center
- Taipei Veterans General Hospital Department of Neurology
- Buddhist Tzu Chi General Hospital Department of Neurology
- National Taiwan University Hospital Medical Research Conference
- National Dong Hwa University Department of Electrical Engineering & Institute of Electrical Engineering
- National Central University Department of Electrical Engineering