Kun-Ching Wang's Curriculum Vitae

IEEE Membership No.: 92315474

Name： **Kun-Ching Wang**

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Biography

Kun-Ching Wang (S'02–M'12-SM'19) was born in Kaohsiung, Taiwan in 1976. Currently, he is a professor of Mechanical and Computer-Aided Engineering at Feng Chia University in Taiwan. He received the B.S. degree in electric engineering from Southern Taiwan University of Technology in 1998 and M.S. degree in electric engineering from Feng Chia University in 2000, and the Ph.D. degree in control engineering from National Chiao-Tung University (NCTU), Hsinchu, Taiwan, in 2005. He was a Professor and Director of teaching and development center II (2015-2018) and the Department Chair (2012-2015). He was an Assistant Professor (2008-2011), and Associate Professor (2011-2015) of Dept. of Information Technology & Communication Shih-Chien University Kaohsiung Campus in Taiwan. He is also currently serving as the Deputy Secretary General of the Taiwan Association of Systems Science and Engineering (TASSE). He serves as Special Session Organizer of 2019 IEEE International Conference on Consumer Electronics – Taiwan, Chairman of affairs of 2019 National Symposium on Systems Science and Engineering (NSSSE 2019), and the Section Chair of ICSSE 2017, DLT 2017, ITA 2016 and CVGIP 2010. His research interests include speech/audio processing and recognition, machine learning, computer vision, advanced driver assistance systems, and IoT application. His research results have been published on over 40 journal and conference papers.

Education

2000 – 2005 **National Chiao Tung University, Hsinchu, Taiwan**
Pursuit Ph.D. degree in Graduate Institute of Electrical and Control Engineering
Chaotic Systems and Signal Processing Lab, CSSP Lab.
Thesis: A Study of Frequency Band and Wavelet Analysis for Robust Voice Activity Detection
Advisor：Prof. Bing-Fei Wu (IEEE Fellow)

1998 – 2000 **Feng Chia University, Taichung, Taiwan**
Master of Science in Graduate Institute of Electrical Engineering
Thesis: Field Analysis of Small Aerospace Generator Using Finite Elements
Advisor：Prof. Chang-Chou Hwang

1996 – 1998 **Southern Taiwan University of Technology, Tainan, Taiwan**
Department of Electrical Engineering
B.S. Electrical Engineering

1991 – 1996 **National Kaohsiung University of Applied Science, Kaohsiung, Taiwan**
Five-years college in Electrical Engineering

Work Experiences

2020.08 – now **Professor,**
Department of Mechanical and Computer-Aided Engineering,
Feng Chia University, Taichung, Taiwan

2015.08 – 2020.07 **Professor,**
Department of Information Technology & Communication,
Shih Chien University, Kaohsiung, Taiwan

2011.07 – 2015.07 **Associate Professor,**
Department of Information Technology & Communication,
Shih Chien University, Kaohsiung, Taiwan

2008.02 – 2011.06 **Assistant Professor,**
Department of Information Technology & Communication,
Shih Chien University, Kaohsiung, Taiwan

2006.01–2008.01 **R&D,**
Video and optical communications technology group
Industrial Technology Research Institute, Hsinchu, Taiwan

Research Interests

Speech/Audio Processing and Recognition
Machine Learning
Computer Vision
Advanced Driver Assistance Systems
Internet of Things (IoT) Application

Professional Activities

- **Special Session Organizer**, 2019 IEEE International Conference on Consumer Electronics – Taiwan
- **Chairman of affairs**, 2019 National Symposium on Systems Science and Engineering (NSSSE 2019)
- **Competition reviewer**, 2018 Southern District High School Task Competition
- **Section Chair**, International Conference on System Science and Engineering 2017 (ICSSE 2017)
- **Section Chair**, DLT 2017
- **Section Chair**, ITA 2016
- **Section Chair**, CVGIP 2010
- **Academic speech**, Department of Information Engineering, National Pingtung University
- **Technical Reviewer,** IET Signal Processing
- **Technical Reviewer,** IET Electronics Letters
- **Technical Reviewer,** EURASIP Journal on Advances in Signal Processing
- **Technical Reviewer,** Digital Signal Processing
- **Technical Reviewer,** IEEE Signal Processing Letters
- **Technical Reviewer,** IEEE Transactions on Speech and Audio Processing
- **Technical Reviewer,** IEICE Transactions on Fundamentals
- **Technical Reviewer,** ELSEVIER Computers & Electrical Engineering
- **Technical Reviewer,** MDPI Entropy Journal

- **Technical Reviewer,** Journal of Kao-Tech University - Engineering and Technology

Membership in Professional Societies

- **Member, IEEE - Institute of Electrical and Electronics Engineers, Taipei Section, (Societies: Systems, Man, and Cybernetics Society, Computational Intelligence Society, Computer Society, Signal Processing Society, Consumer Electronics Society, Industrial Electronics Society)**
- **Member, IEICE - The Institute of Electronics, Information and Communication Engineers**
- **Member, International Speech Communication Association, (ISCA)**
- **Member, the Association for Computational Linguistics and Chinese Language Processing, (ACLCLP)**
- **Member, Chinese Automatic Control Society, (CACS)**
- **Member, Taiwan Association of System Science and Engineering**

Honors/ Awards

2019 Serve as the **Vice General Secretary** of the Taiwan Association of Systems Science and Engineering (TASSE)

2019 Award the **reward special talents** of 108th Ministry of Science and Technology

2018 Award of **runner-up (Creative Ideas Group)** of the 2018 Ministry of Economic Affairs

2018 Award the **excellent** (Social Care Group) of 2018 New Creation Cup National College Creative Innovation Entrepreneurship Competition

2018 Award **excellent (Innovation Concept Group)** of the 2018 Automotive Electronics Innovation Invention Competition

2018 Award the **reward special talents** of 107th Ministry of Science and Technology

2017 Award the 104th Year Excellent Mentor of Shih-Chien University

2017 Award the **reward special talents** of 106th Ministry of Science and Technology

2016 Award the **reward special talents** of 105th Ministry of Science and Technology

2015 Award the **reward special talents** of 104th Ministry of Science and Technology

2014 Award the **reward special talents** of 103th Ministry of Science and Technology

2014 Guiding students won the NSC103 Projects of college students

2014 Award the **excellent** (Social Care Group) **of** the 2014 Ministry of Economic Affairs

2013 Award the 102th NSC **Special Talents reward**

2013 Guiding students won the NSC102 Projects of college students

2013 Award the Competition of the 9th National Electronic Design Ideas

2012 Award the 101th NSC **Special Talents reward**

2012 Award the **reward special talents** of 102th Ministry of Science and Technology

2011 Award the 100th NSC Special Talents reward

2010 Guiding students won NSC99 Projects of college students

2007 Technology Transfer to XGI Technology Inc.

2006 Technology Transfer to Terwins Technology Inc.

2003 3th Golden Silicon Awards by MXIC Technology Inc.

Research Grants

1. Development of Intelligent Beehive Monitoring System Based on Deep Multi-scale Wavelet Convolution Neural Network: from Identifying Healthy Bees Buzz, **Principle Investigator**, NTD: 601,000 supported by Ministry of Science and Technology, Taiwan, under Grant No. MOST 109-2622-E-035-022-, (11/01/2020 - 10/31/2021).
2. The Study and Implementation of AI Driving Behavior Analysis System Based on Bi-Modal Deep Convolution Neural Network Technology from Acoustical-Visual Features, **Principle Investigator**, NTD: 847,000 supported by Ministry of Science and Technology, Taiwan, under Grant No. MOST 108-2221-E-158-003-, (08/01/2019 - 10/31/2020).
3. The Study of Infant Cry Recognition Using Multi-Resolution Convolutional Neural Network Based on Deep Learning, **Principle Investigator**, NTD: 741,000 supported by Ministry of Science and Technology, Taiwan, under Grant No. MOST 107-2221-E-158-003-, (08/01/2018 - 10/31/2019).
4. The Study of Speech Endpoint Detection Based on Deep Learning, **Principle Investigator**, NTD: 627,000 supported by Ministry of Science and Technology, Taiwan, under Grant No. MOST 106-2221-E-158-004-, (08/01/2017 - 10/31/2018).
5. Speech/Music Discrimination Using Hybrid-Based Feature Extraction Applying for Audio Data Indexing, **Principle Investigator**, NTD: 512,000 supported by Ministry of Science and Technology, Taiwan, under Grant No. MOST 105-2221-E-158-005-, (08/01/2016 - 10/31/2017).
6. The Study of Automobile-used Voice-Activity Detection System Based on Two-Dimensional Long-Time and Short-Frequency Spectral Entropy Combined with Single-type Recursive Fuzzy Network, **Principle Investigator**, NTD: 664,000 supported by Ministry of Science and Technology, Taiwan, under Grant No. MOST 104-2221-E-158-002-, (08/01/2015 - 7/31/2016).
7. The Study and Implementation of Speech Emotion Recognition System Based on Two-Dimensional Texture Image Information Applying in Tele-Home Care, **Principle Investigator**, NTD: 475,000 supported by Ministry of Science and Technology, Taiwan, under Grant No. MOST 103-2221-E-158-003-, (08/01/2014- 10/31/2015).
8. The Study of Automatic Classification of MP3 Music Objects Based on Principal Component Analysis and Support Vector Machine and Implementation of ARM-based Embedded System, Principle Investigator, NTD: 760,000 supported by Ministry of Science and Technology, Taiwan, under Grant No. MOST 102-2221-E-158-006-, (08/01/2013 - 10/31/2014).
9. A Development of Voice-activity Detection with Low Computation and High Accuracy for Hand-held Mobile Device, **Principle Investigator**, NTD: 433,000 supported by National Science Council, Taiwan, under Grant No. NSC 101-2221-E-158-005-, (08/01/2012 - 07/31/2013).
10. The study of voice activity detection based on eigen-space analysis and multiple time-frequency speech feature weighted combination, **Principle Investigator**, NTD: 459,000 supported by National Science Council, Taiwan, under Grant No. NSC 100-2221-E-158-010, (08/01/2011 - 07/31/2012).
11. Implementation of Real-Time Speech Enhancement with Digital Signal Processor for Digital Hearing Aids, **Principle Investigator**, NTD: 573,000 supported by National Science Council, Taiwan, under Grant No. NSC 99-2221-E-158-006-, (08/01/2010 - 07/31/2011).

12. The Study on Noise Spectrum Estimation with Human Voice Properties to Implement a Real-Time Speech Enhancement System, **Principle Investigator**, NTD: 681,000 supported by National Science Council, Taiwan, under Grant No. NSC 98-2221-E-158-004-, (08/01/2009 - 07/31/2010).
13. The Study of a Single Channel Speech Enhancement Based on Auditory Masking Effect and Wavelet Thresholding to Apply into Variable Noise-Level Environment, **Principle Investigator**, NTD: 550,000 supported by National Science Council, Taiwan, under Grant No. NSC 97-2218-E-158-003- (08/01/2008 - 07/31/2009).

Publication List

<Journal>

1. **Kun-Ching Wang**, "Robust Audio Content Classification Using Hybrid-Based SMD and Entropy-Based VAD", *Entropy*, Vol. 22, Issue 2, no.183, pp.1-24, Feb. 2020. **(SCI, Impact Factor: 2.419 (2018); 5-Year Impact Factor: 2.505 (2018); Rank Factor=28/81=Top 34.56%)**
2. Yi-Horng Lai, Lan-Yuen Guo, **Kun-Ching Wang**, Jau-Woei Perng*, "Dynamical Control for the Parametric Uncertain Cancer Systems," *International Journal of Control, Automation and Systems*, Vol. 18, pp.2411–2422, Feb. 2020. **(SCI, Impact Factor=2.181(2018); Rank Factor=32/62=51.61%)**
3. Ying-Jen Chen, Hao-Gong Chou, Wen-June Wang, Shun-Hung Tsai, Kazuo Tanaka, Hua O. Wang, and **Kun-Ching Wang,** "A polynomial-fuzzy-model-based synchronization methodology for the multi-scroll Chen chaotic secure communication system," Accepted for publication in *Engineering Applications of Artificial Intelligence*, Sept. 2019. **(SCI, Impact Factor: 3.526 (2018); 5-Year Impact Factor: 3.640 (2018), Rank Factor=15/88=Top 17%)**
4. Shih-Hsin Chen, Yeong-Cheng Liou, Yi-Hui Chen and **Kun-Ching Wang,** "Order Acceptance and Scheduling Problem with Carbon Emission Reduction and Electricity Tariffs on a Single Machine," Accepted for publication in *Sustainability*, Sept. 2019. **(SCI, Impact Factor: 2.592 (2018); 5-Year Impact Factor: 2.801 (2018), Rank Factor=105/250=Top 42%)**
5. Yi-Horng Lai; Lan-Yuen Guo; Jau-Woei Perng; **Kun-Ching Wang,** "Dynamical Control for the Parametric Uncertain Cancer Systems," Revised to *International Journal of Control, Automation and Systems*. Sept. 2019. **(SCI, Impact Factor=2.181(2018))**
6. **K.C. Wang (single author),** "Speech Emotion Classification using Texture Image Information Feature", International Journal of Signal Processing System, vol.3, no.1, June, 2015.
7. **K. C. Wang (single author)**, "Time-Frequency Feature Representation Using Multi-Resolution Texture Analysis and Acoustic Activity Detector for Real-Life Speech Emotion Recognition," SENSORS, Vol. 15, no. 1, pp. 1458-1478, Jan. 2015. (SCI, Impact Factor: 2.245 (2014); 5-Year Impact Factor: 2.474 (2014), Rank Factor=10/56=Top 17.8%)
8. **K. C. Wang (single author)**, "The Feature Extraction Based on Texture Image Information for Emotion Sensing in Speech**,"** *SENSORS*, Vol. 14, no. 9, pp. 16692-16714, Sept. 2014. **(SCI, Impact Factor: 2.245 (2014); 5-Year Impact Factor: 2.474 (2014), Rank Factor=10/56=Top 17.8%)**
9. **K. C. Wang (single author),** "A Novel Voice Sensor for the Detection of Speech Signals," *SENSORS*, Vo.13, No.12, pp.16533-16550, Dec. 2013. **(SCI, Impact Factor: 2.048 (2013); 5-Year Impact Factor: 2.457 (2013), Rank Factor=10/57=Top 17.5%)**
10. **K. C. Wang (single author),** "Horizontal Spectral Entropy with Long-Span of Time for Robust Voice Activity Detection," *IEICE Trans. on Information and Systems*, Vol.E96-D No.9 pp.2156-2161, Sept. 2013. **(SCI, Impact Factor=0.369, Rank Factor=91/99)**
11. **K. C. Wang (single author),** "A Novel Approach Based on Adaptive Long-term Sub-band Entropy and Multi-thresholding Scheme for Detecting Speech Signal," *IEICE Trans. on Information and*

Systems, Vol.E95-D, No.11, pp.2732-2736, Nov. 2012. **(SCI, Impact Factor=0.369, Rank Factor=91/99)**

12. **K. C. Wang (single author),** "Voice-Activity Detection Using Long-Term Sub-Band Entropy Measure," *IEICE Trans. on Fundamentals*. Vol.E95-A, No.9, pp.1606-1609, Sept. 2012. **(SCI, IF=0.366, Rank Factor = 193/245)**
13. C. L. Chin, **K. C. Wang** and W. S. Jhao, "A Document Image Binarization Algorithm with Fuzzy Inference Method" *The Chung Shan Medical Journal,* Vol. 22, pp.417-434, Dec. 2011.
14. **K. C. Wang (first author)** and C. L. Chin, "An Approach Using Combination of Multiple Features through Sigmoid Function for Speech-presence/absence Discrimination," *IEICE Trans. on Fundamentals,* Vol.E94-A, No. 8, pp.1630-1637, Aug. 2011. **(SCI, IF=0.366, Rank Factor = 193/245)**
15. **K. C. Wang (single author),** "Voice Activity Detector for Noise Spectrum Estimation Using a Dynamic Band-Splitting Entropy Estimate," *International Journal of Computers and Applications*, Vol. 33, No. 3, Jul. 2011**(EI)**
16. **K. C. Wang (single author),** "An Adaptive Wavelet-Based Denoising Algorithm for Enhancing Speech in Non-Stationary Noise Environment," *IEICE Transactions on Information and Systems*, vol. E93-D, No.2, pp. 341-349, Feb. 2010. **(SCI, Rank Factor=91/99, Impact Factor=0.369)**
17. **K. C. Wang (first author)** and C. L. Chin, "A Time-Frequency Adaptation Based on Quantum Neural Networks for Speech Enhancement," *WSEAS Transactions on Information Science and Applications*, Volume 7, Issue 1, pp. 11-15, January 2010. **(EI)**
18. **K. C. Wang (single author),** "Wavelet-Based Speech Enhancement Using Time-Frequency Adaptation," *EURASIP Journal on Advances in Signal Processing*, vol. 2009, pp. 1-8, Oct. 2009. **(SCI, Rank Factor=115/229, 5-Year Impact Factor=1.074)**
19. **K. C. Wang (single author),** "A Wavelet-Based Voice Activity Detection Algorithm in Variable-Level Noise Environment," *WSEAS Transactions on Computers*, Vol. 8, Issue 6, pp. 949-955, June 2009. **(EI)**
20. **K. C. Wang (first author)** and C. L. Chin, "An Efficient Voice Activity Detection in Realistic Environments," *WSEAS Transactions on Systems*, vol.6, pp. 1207-1212, Jul. 2007. **(EI)**
21. B. F. Wu and **K. C. Wang (corresponding author)**, "Speech Activity Detection Based on Auto-Correlation Function Using Wavelet Transform and Teager Energy Operator," *International Journal of Computational Linguistics and Chinese Language Processing*, vol. 11, no. 1, pp. 87-100, Mar. 2006.
22. B. F. Wu and **K. C. Wang (corresponding author)**, "Noise Spectrum Estimation with Entropy-based VAD in Non-stationary Environments," *IEICE Transactions on Fundamentals of Electronics Communications and Computer Sciences*, vol. E89-A, no. 2, pp. 479-485, Feb. 2006. **(SCI, 5-Year Impact Factor =0.444)**
23. B. F. Wu and **K. C. Wang (corresponding author)**, "A Robust Endpoint Detection Algorithm Based on the Adaptive Band-Partitioning Spectral Entropy in Adverse Environments," *IEEE Transactions on Speech and Audio Processing*, vol. 13, no. 5, pp. 762-775, Sep. 2005. **(SCI, 5-Year Impact Factor =1.853)**
24. B. F. Wu and **K. C. Wang (corresponding author)**, "A Robust Entropy-Based Speech Detection in High Noisy Environments," *GESTS International Transactions on Speech Science and Engineering*, vol. 2, no. 1, pp. 79-90, Feb. 2005. **(Invited Paper)**

<Conference>

[1] **K. C. Wang**, Y. R. Yang and Y. M. Yang, "The Study on Infant Cry Recognition Using Multi-Resolution Deep CNN Architecture", 2019 International Conference on Technology, Engineering, Science, and Application (ICTESA 2019), Fukuoka International Congress Center, Fukuoka, Japan. April 1 -3, 2019.

[2] **K. C. Wang**, Y. R. Yang and Y. M. Yang, "Voice Activity Detection Based on Deep Learning (paper ID: 10)," 2018 3rd International Conference on Biomedical Signal and Image Processing (ICBSIP 2018), Seoul, South Korea, July 22-24, 2018.

[3] **K. C. Wang**, Y. M. Yang and Y. R. Yang, "Speech/Music Discrimination using Hybrid-Based Feature Extraction for Audio Data Indexing," Proceedings of the International Conference on System Science and Engineering 2017 (ICSSE 2017), pp. 537-541, Ho Chi Minh City, Vietnam, July 21-23, 2017.

[4] **K. C. Wang**, "The Study of Automobile-Used Voice-Activity Detection System Based on Two-Dimensional Long-Time and Short-Frequency Spectral Entropy," The Fourth International Conference on Technological Advances in Electrical, Electronics and Computer Engineering (TAEECE 2016), pp. 54-61, Kuala Lumpur, Malaysia, September 6-8, 2016.

[5] **K. C. Wang**, "A Novel Feature Extraction Based on Multi-Resolutions Texture Image Information and Acoustic Activity Detector for Emotion Recognition in Speech," International Conference on Engineering and Natural Science, 2015 (ICENS 2015), pp. 107-130, July 22-24, Waseda University, Tokyo, Japan.

[6] **K. C. Wang**, "Speech Emotional Classification Using Texture Image Information Features" (SP0006) has been accepted for Oral presentation at 2014 International Conference on Communication and Signal Processing (*ICCSP 2014*) in Bangkok, Thailand.

[7] **K. C. Wang**, C. L. Chin and C. M. Wang, "Innovative VAD Based on Horizontal Spectral Entropy with Long-Span of Time," has been accepted for the International MultiConference of Engineers and Computer Scientists 2013 (*IMECS 2013*), 13-15 March, Hong-Kong.

[8] **K. C. Wang**, "An Adaptive Long-term Sub-band Entropy Measure for Voice Activity Detection (Paper Number: 8060)," Accepted to *BAI 2012*. Jul. 3- Jul. 5, 2012.

[9] **K. C. Wang**, Chiun-Li Chin and Yi-Hsing Tsai, "A Novel Voice Activity Detection Method Using Improved Long-Term Spectral Analysis and Wavelet Entropy (Paper ID: 206)," has been accepted for Oral Presentation at *2012 Third International Conference on Audio, Language and Image Processing* (ICALIP 2012), Shanghai, China, July 16 - July 18, 2012.

[10] C. M. Wang, **K. C. Wang** and C. L. Chin, "Decision-making and Recognition in Emotional Speech," has been accepted for Oral Presentation at the *18th Cross Strait Conference on Information Management Development and Strategy* (CSIM 2012), Taipei, Taiwan, Aug. 20 - Aug. 21, 2012.

[11] **K. C. Wang**, C. L. Chin and Y. H. Tsai, "The Combination Strategy of Multiple Features Derived from Bark-Scale Wavelet Domain for a Classification of Speech/Non-Speech (paper 1569379055)" has been accepted for presentation at *2011 IEEE Symposium on Computers and Informatics*, Jan. 2011. (20 - 22 March 2011, Kuala Lumpur, MALAYSIA)

[12] **K. C. Wang**, C. L. Chin and Y. H. Tsai," The Classification of Speech/non-speech using Multiple Features Derived from Bark-Scale Wavelet Domain (Paper ID: P0129)," has been accepted for presentation at *2011 International Conference on Data Engineering and Internet Technology (DEIT 2011)* to be held 15-17 March 2011, Bali, Indonesia.

[13] C. L. Chin, W. S. Jhao and **K. C. Wang**, "A Robust Document Image Binarization Algorithm with Artificial Intelligent Method," accepted by *the 2010 International Congress on Computer Applications and Computational Science (CACS 2010)*, 4-6 December 2010, Singapore.

[14] C. L. Chin and W. S. Jhao and **K. C. Wang**, "A Document Image Binarization Algorithm with Fuzzy Inference Method, " accepted by *CVGIP 2010*, 15-17 Aug. 2010, Kaohsiung.

[15] **K. C. Wang**, C. L. Chin and Y. H. Tsai, "Voice Activity Detection based on Combination of Weighted Sub-band Features using Auto-Correlation," *Proceedings of DiSS-LPSS Joint Workshop 2010*, pp. 83-88, 25-26 September 2010, Tokyo, Japan.

[16] Y. H. Tsai, C. C. Tsai and **K. C. Wang**, "Automatic Content-Based Classification of MP3 Music Objects Radial Basis Function Network, " accepted by the *7th International Conference on Fuzzy Systems and Knowledge Discovery (FSKD'10)*, 10-12 August 2010, Yantai, China.

[17] C. L. Chin, H. H. Tsai, Y. C. Cheng, and **K. C. Wang**, "Automatic Pulmonary Embolism Detection System," *The 22th IPPR Conference on Computer Vision, Graphics, and Image Processing*, August 2009

[18] **K. C. Wang**, T. L. Hou, C. L. Chin, "Voice Activity Detection Using Spectral Entropy in Bark-Scale Wavelet Domain," accepted by *ROCLING 2009*, , 1-2 September 2009 , July, 2009. in Taichung, Taiwan.

[19] **K. C. Wang**, C. L. Chin and Y. H. Tsai, "A Wavelet De-noising System Using Time-Frequency Adaptation for Speech Enhancement Adaptation for Speech Enhancement," *International Conference on Asian Languages Processing 2009 (IALP2009)*, pp.114-117, Dec 7-9, 2009, Singapore.

[20] **K. C. Wang**, "A Novel Entropy-Based Voice Activity Detection Algorithm," accepted by *2009 International Conference on Business and Information - Challenges and Prospects of the 21st Century*, May 1-2, 2009, Kaohsiung, Taiwan.

[21] C. L. Chin, **K. C. Wang**, and S. M. Chiou, "Curve-based Image Lightness Enhancement Algorithm," *International Workshop on Computer Vision and Its Application to Image Media Processing*, January 2009.

[22] **K. C. Wang**, "An Entropy-Based VAD Technique Using Bark-Scale Wavelet Decomposition and Adaptive Frequency Sub-band Extraction," accepted by *Oriental COCOSDA 2008*, Nov. 25-27 2008, Kyoto, Japan.

[23] **K. C. Wang**, "A Novel Speech Enhancement Based on Time-Frequency Adaptive Thresholding of the Perceptual Wavelet Packet Transform," accepted by *Oriental COCOSDA 2008*, Nov. 25-27 2008, Kyoto, Japan.

[24] **K. C. Wang**, "A Method with Entropy-Based Measure for Detecting Voice Activity in Noisy Environments," accepted by *The 6th International Symposium on Chinese Spoken Language Processing, ISCSLP 2008*, December 16-19, 2008, Kunming, China.

[25] **K. C. Wang**, "Voice Activity Detection Based on Discrete Wavelet Transform," accepted by *ROCLING-2008*, Sep. 4~5, 2008, Taipei, Taiwan.

[26] **K. C. Wang** and Y. H. Tsai, "Voice Activity Detection Algorithm with Low Signal-to-Noise Ratios Based on Spectrum Entropy," *Second International Symposium on Universal Communication, ISUC 2008*, pp. 423~428, Dec. 15-16, 2008, Osaka, Japan.

[27] B. F. Wu and **K. C. Wang**, "An Adaptive Band-Partitioning Spectral Entropy Based Speech Detection in Realistic Noisy Environments," *INTERSPEECH 2004 ICSLP*, vol. 2, pp. 957~960, Oct. 4~8, 2004, Jeju Island, Korea.

[28] B. F. Wu, **K. C. Wang** and L. Y. Kuo, "A Noise Estimator with Rapid Adaptation in Variable-Level Noisy Environments," *ROCLING XVI*, pp. 33~38, Sep. 2~3, 2004, Taipei, Taiwan.

Significant Research Results

1. Development of a Bi-Modal Deep CNN-based Driving Behavior Analysis System:

Dr. Wang has proposed an AI Driving Behavior Analysis System Based on Bi-Modal Deep Convolution Neural Network (BDCNN) Technology from Acoustical-Visual Features since 2018. The research was funded by Grant No. MOST 108-2221-E-158-003-.

His motivation on developing a set of AI driving behavior analysis and information service systems, which can achieve driving reminders and improve the effect of good driving through the cloud computing, big data database and AI deep learning technology. In addition, it not only solves the incidence of car accidents, but also helps to judge the driving skills of driving and to insure the corresponding insurance. Furthermore, it can generate reasonable insurance and premium services according to driving behavior. Dr. Wang proposed BDCNN-based system is that let the computer learn to recognize the characteristics of the driver's voice emotion in the sound spectrum image. Experimental result shows that the dual-mode emotional deep learning network architecture can analyze the difference of the driver's voice emotion in the sound spectrum by computer vision, and use the filter to perform convolution operation on the frequency axis of the sound spectrum to train and extract the features repeatedly. The driving management mode is successfully used for preventive management to prevent the occurrence of abnormal behaviors by understanding the causes of abnormal driving, and further reduce the chance of accidents.

In summary, Dr. Wang established a set of methods for analyzing driver's emotions through driver's voice message and facial emotion characteristics and dual-mode emotional deep learning network model, which combined with OBD-II (On-Board Diagnostics-II) and Internet of Things technology, is contribution for Advanced Driver Assistance Systems (ADAS) in autonomous driving system.

2. Development of Infant Cry Recognition Using Multi-Resolution Convolutional Neural Network Based on Deep Learning:

Newborn infants often send messages in a crying form before they learn human languages. In the past, the literature shows that babies express emotional or pathological reactions through crying. Although clinically known several reasons why babies are crying, most of them are judged empirically for lack of objectivity in actual resolution. Therefore, Dr. Wang proposed a multi-resolution convolutional neural network in order to resolve the crying of newborn babies so as to help them give comfort to their babies in time and reduce their parents' burden. How to correctly detect the baby's cries and then analyze them owing that the sound event come from all directions are contributed for this research. And then the research was funded by Ministry of Science and Technology, Taiwan, under Grant No. MOST 107-2221-E-158-003-.

In this research, Convolutional Neural Network (CNN) is used as a deep learning model for emotion features. A deep learning multi-resolution convolution neural network is used to identify new students Baby crying sounds of seven emotions cry: Hungry, Pain, Eructation, Tiredness, Discomfort, Colic, and pathological. First, a low-complexity logistic regression classification is utilized as a pre-processing method for automatically detecting infant cries, the infant cries / non-infant cries are detected efficiently. So, the represented Emotions are further analyzed by the cries when it is determined as a baby crying sound. Secondly, the one-dimensional infantile crying message is presented as a two-dimensional spectroscopic image. Multi-resolution features of four key sub-bands are then analyzed by different size filters to allow the computer to achieve multi-resolution spectral images Newborn baby crying features learning. In addition, the eigenvectors output from the four key subbands are concatenated to complete the emotion feature learning model to accurately analyze the emotional or pathological information represented by the newborn baby crying sound. The research will also collect and establish a large database of cloud emotions of infants and infant crying to improve the accuracy of recognition. Finally, Dr. Wang proposed recognition infant cry using multi-resolution deep convolutional neural network can successfully classify the emotion of infants crying through SVM classifier.

3. Implementation of Automobile-used Voice-Activity Detection System Based on Two-Dimensional Long-Time and Short-Frequency Spectral Entropy Combined with Single-type Recursive Fuzzy Network:

The interactive concept of the intelligent automobile has been pursued and aspired for people in the future all the time. Owing to the maturity of electronic IT technologies applied into car, the concepts of a lot of intelligent automobiles become real day by day. Hi-Tech equipments, such as electron in the automobile, etc. are a feast for the eyes, not only offer safer driving information to a driver but also offered a demand of amusement to the media. Speech recognition has been improved for a latest intelligent automobile; however, the key technology still lies in the

technology of voice-activity detection (VAD). Because it will cause the noise degree change that the speed changes in the automobile goes, and affects the efficiency of voice-related technology applied into automobile. So, how to propose a learnable VAD that it is can quickly adjusted with noise degree change is very important and overcome issue.

Dr. Wang has proposed the characteristic parameter of two-dimensional entropy of and short span of frequency, it make up of horizontal spectral entropy with long span of time (HSELT) and vertical spectral entropy with short span of frequency (VSESF). This research was funded by Ministry of Science and Technology, Taiwan, under Grant No. MOST 104-2221-E-158-002-). Dr. Wang can further find that the signal of change can be detected through HSELT. And then using HSELT to enhance the transaction between speech and noise when the pronunciation signal appears in the noise signal of the background. So, the HSELT can be utilized to measure the variance among the long-term segment and further to detect the endpoint. But the HSELT seems unable to characterize the speech signal. In addition, Dr. Wang found that the VSESF can successfully describe the voice-print on spectrogram. But the VSESF seems unable to define the colored noise. Based on the above the findings, this plan will integrate the two-dimensional spectral entropy to complement the drawback from each other. Consequently, Dr. Wang separated it from observed signal and denote the number of signals by HSELT when the signal received changes. Secondly, Dr. Wang performed VSESF in order to make voice-like judgment for the observed signal. Finally, Dr. Wang utilized a recurrent property in order to deal with problems with temporal characteristics, especially in the learning ability of the type of singleton-type recurrent neural fuzzy network that it can help to avoid and need to determine a threshold value.

4. Implementation of Speech Emotion Recognition System Based on Two-Dimensional Texture Image Information Applying in Tele-Home Care:

Due to the aging population structure in the country, the demand for medical services and long-term care has increased significantly. Therefore, the development of remote home care has become one of the main directions. According to statistics, the emotional ups and downs of the elderly at home are often accompanied by high risks. Therefore, if the accident can be prevented in the first time, the risk of elderly people at home can be greatly reduced and the burden of long-term care can be reduced.

According to the finds, Dr. Wang proposed an Implementation of Speech Emotion Recognition System Based on Two-Dimensional Texture Image Information Applying in Tele-Home Care. This research was funded by Ministry of Science and Technology, Taiwan, under Grant No. MOST 103-2221-E-158-003-). The motivation of this research is to apply the speech emotion recognition technology to the remote home care system. In addition to the semantic expression, the emotional expression of the tone is also an important part of communication. Because most of the elderly at home do not reveal their emotions, they use the mobile app to read the heart, analyze and diagnose the correct voice characteristics of the interaction with the elderly at home, and further learn the immediate emotional state of the elderly at home, and make an immediate response or condolence care, etc. is very important.

In order to enhance traditional speech emotional recognition rate of poor emotional situation, Dr. Wang proposed an improve feature parameter method based on two-dimensional texture image information. And then combined with the limbs fall detection mechanism, Dr. Wang has implemented a mobile emotional speech with the cloud concept at the application environment in THC. Such as using Kinect, LEGO Robotics and PSoC (Programmable System-on-Chip) and other embedded systems, a THC system has successfully established to monitor behavior and emotional perception for elderly.

5. Development of Automatic Classification of MP3 Music Objects Based on PCA and SVM and Implementation of ARM-based Embedded System:

In recent years, the retrieval of multimedia is important, the classification for multimedia content become more popular. For multimedia audio music, MP3 music objects have become the popular type of music file in many internet audio applications. However, many researchers mainly focus on the formant of MIDI or WAV for uncompressed music. They seldom discuss the music form which is compressed. In this project, Dr. Wang provided a named as matrix of subband coefficient vector (MSCV) which is from subband domain and MDCT spectrum. The MSCV indicates the spectral intensity on each subband as feature extraction for MP3 music. Meantime, Dr. Wang consider the bandwidth, low Energy, centroid frequency and roll off to determine the characteristic of music. Besides, Dr. Wang let the data dimension decrease by using the principle component analysis and develop an automatic classification of MP3 music object by using the support vector method. Finally, Dr. Wang transplanted the whole

system of the classification of MP3 music object to ARM-based embedded system platform to achieve an implementation of real-time. The research was funded by Ministry of Science and Technology, Taiwan, under Grant No. MOST 102-2221-E-158-006-.

6. Implementation of Real-Time Speech Enhancement with Digital Signal Processor for Digital Hearing Aids:

In this project Dr. Wang has illustrated the development of DSP-based speech enhancement algorithm as the use of digital hearing aids for impaired-hearing listeners. First, Dr. Wang proposed the method including the noise spectral estimation and spectral weight evaluation to reduce the amount of residual noise. Then, Dr. Wang used equivalent-rectangular-bandwidth as frequency division for the auditory difference between impaired-hearing listeners and normal-hearing listeners. Furthermore, Dr. Wang adopted rounded exponential to achieve an appropriate auditory model of impaired-hearing listeners. Besides, Dr. Wang made use of auditory-masking concept to determine the auditory-masking-threshold of impaired-hearing listeners and then expect to perform different enhancement algorithm for damage-level of hearing. Due to that auditory system is sensitive to spectral energy of low frequency subband, Dr. Wang finally used the companding to enhance the formant frequency in low frequency to gain more auditory quality. Consequently, Dr. Wang performed formant enhancement during speech-presence frame. Conversely, Dr. Wang don't perform formant enhancement during noise-only frame. After development of algorithm, in proposed algorithm Dr. Wang analyzed the computational complexity for each of functionality and perform appropriate process of fixed-point for the architectures and characteristics of DSP. Besides, in order to real-time implementation of platform for digital hearing aids, Dr. Wang adopted the concept of pipelining to raise the instruction efficient. The research was funded by Ministry of Science and Technology, Taiwan, under Grant No. NSC 99-2221-E-158 -006 -.