

ZULFIQAR ALI, Ph.D.

Researcher, Digital Speech Processing Group

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BIOGRAPHY

I have more than 16 years of working experience in renowned national and international institutions, including seven years of research and more than nine years of teaching. In addition, my role as a member of the board of studies in the GIFT University and the University of Gujrat was significant in design and approval of curriculums for bachelor and master degrees of computer science. I have completed Ph.D. in Electrical and Electronics Engineering (major in *Digital Speech and Image Processing*) from Universiti Teknologi PETRONAS (UTP), Malaysia. I obtained MS and M.Sc. degrees in Computer Science from the University of Engineering and Technology (UET), Lahore. I have a strong background in mathematics as I completed M.Sc. Mathematics in 2001 from the University of the Punjab, Lahore. Since 2010 as a researcher in King Saud University, I am doing research in the area of speech/speaker recognition, biomedical signal processing, cloud and multimedia for healthcare, security and privacy, watermarking, steganography, and multimedia forensics. I have numerous publications in journals and conferences of international repute and have a very active research profile. The total impact factor of my international journal publications according to 2016 journal citation report is 42.34. I have been involved in various scientific research projects funded by National Science Technology and Innovation Plan (NSTIP), King Abdul Aziz City for Science and Technology (KACST), Saudi Arabia, and Deanship of Scientific Research, King Saud University, Saudi Arabia. Under the scope of the projects, two speech databases have been recorded, and Linguistic Data Consortium (LDC), University of Pennsylvania, USA, published one of the databases.

EDUCATION

PhD Electrical and Electronic Engineering 2017 (Major: Digital Signal Processing)	Centre for Intelligent Signal and Imaging Research (CISIR), Universiti Teknologi PETRONAS (UTP), Malaysia. Thesis Title: Pathology Assessment Methods for Vocal Fold Disorders
MS Computer Science 2010 (Major: System Engineering)	University of Engineering and Technology (UET), Lahore, Pakistan. <ul style="list-style-type: none">• Grade: A (First Division)Thesis Title: A Confusion Matrix based Multiple Classifier System for Text-independent Speaker Identification System
M.Sc. Computer Science 2007	University of Engineering and Technology (UET), Lahore, Pakistan. <ul style="list-style-type: none">• Grade: A (First Division)Thesis Title: A Study of Voice Feature Vector Analysis Techniques for Speaker Identification
M.Sc. Mathematics 2000	University of the Punjab, Lahore, Pakistan. <ul style="list-style-type: none">• First Division
Bachelor of Science 1998	University of the Punjab, Lahore, Pakistan. <ul style="list-style-type: none">• First Division

WORKING EXPERIENCE

Oct 2010 – Present **King Saud University, Riyadh, Saudi Arabia.**

Position: Researcher in Digital Speech Processing Group

- Department of Computer Engineering, College of Computer and Information Sciences

Mar 2009 – Oct 2010 **University of Gujrat, Gujrat, Pakistan.**

Position: Lecturer (BPS-18) Regular

- Teaching to BS & M.Sc Computer Science
- Member, Board of Studies of CS & IT Department
- Secretary, Curriculum Committee of CS & IT Department
- Member, Examination Committee of CS

Jan 2008 – Feb 2009 **GIFT University, Gujranwala, Pakistan.**

Position: Lecturer

- Teaching to BS Computer Science
- Member, Board of Studies
- Acting HOD, School of Computer Science from Sep 2008 to Feb 2009

July 2006 - Jan 2008 **COMSATS Institute of Information Technology, Lahore, Pakistan.**

Position: Lecturer

- Teaching to BS Telecom, Electrical Engineering & Computer Engineering

Oct 2002 - July 2006 **GIFT University, Gujranwala, Pakistan.**

Position: Lecturer

- Teaching to BS Computer Science

Aug 2001 - Oct 2002 **Mansoorah Degree College, Lahore, Pakistan.**

- Teaching to BS Mathematics

Some of the courses that I have taught in above mentioned institutions/universities:

- | | |
|--|--|
| 1. Digital Signal Processing | 6. Statistics and Probability |
| 2. Digital Logic Design | 7. Theory of Automata/computation |
| 3. Computer Architecture | 8. Analysis of Algorithm |
| 4. Computer Organization & Assembly Language | 9. Fundamentals of Programming |
| 5. Discrete Structures | 10. Numerical Computing (Using MATLAB/C++) |

SCHOLARSHIPS

- Merit scholarship during bachelor degree 1996-1998.
- Winner of Quaid-e-Azam scholarship during Master degree (1998-1999).

TECHNICAL SKILLS

I have strong programming background in MATLAB. I have done all of my research work in MATLAB since 2006.

RESEARCH INTERESTS

- | | |
|---------------------------------------|----------------------------------|
| • Biomedical Signal Processing. | • Multimedia Forensics |
| • Speech and Speaker Recognition | • Privacy and Security |
| • Digital Image Processing | • Watermarking and Steganography |
| • Cloud and Multimedia for healthcare | |

FUNDED PROJECTS

Currently I am involved in following projects funded by *National Science Technology and Innovation Plan (NSTIP), King Abdul Aziz City for Science and Technology (KACST), Kingdom of Saudi Arabia.*

- | | | |
|---|-------------------|-----------------------|
| 1. Project Title: Arabic Speaker Recognition | | |
| <i>Grant No.:</i> 08-INF167-02 | Status: Completed | Budget: 1 Million SAR |

2. **Project Title:** Automatic voice Pathology Assessment
Grant No.: 12-MED2474-02 **Status:** Completed **Budget:** 2 Million SAR
3. **Project Title:** Computer-Aided Pronunciation Training System for Non-native Learners of the Arabic Language
Grant No.: 13-INF977-02 **Status:** Approved **Budget:** 1.6 Million SAR

SPEECH DATABASE

Mansour Alsulaiman, Ghulam Muhammad, Mohamed A. Bencherif, Awais Mahmood, **Zulfiqar Ali**, “**King Saud University-Arabic Speech Database**”, Catalogue No. LDC2014S02. Web Download. Philadelphia: Linguistic Data Consortium, 2014. ISBN 1-58563-669-X; <https://catalog.ldc.upenn.edu/LDC2014S02>.

INTERNATIONAL JOURNAL PUBLICATIONS / BOOK CHAPTERS

1. **Zulfiqar Ali**, M. Shamim Hossain, Ghulam Muhammad and Arun Kumar Sangaiah, “**An Intelligent Healthcare System for Detection and Classification to Discriminate Vocal Fold Disorders**”, *Future Generation Computer Systems*. (Revision Submitted) (*ISI-IF: 3.997*)
2. **Zulfiqar Ali**, Muhammad Imran, Mansour Alsulaiman, Tanveer A. Zia, and Muhammad Shoaib, “**A Zero-Watermarking Algorithm for Privacy Protection in Biomedical Signals**”, *Future Generation Computer Systems*. (Accepted) (*ISI-IF: 3.997*)
3. Wadood Abdul, **Zulfiqar Ali**, Sanaa Ghounzali, Mansour Alsulaiman, “**Security and Privacy for Medical Images Using Chaotic Visual Cryptography**”, *Journal of Medical Imaging and Health Informatics*. vol. 7, no. 6, pp. 1296-1301, 2017. (*ISI-IF: 0.877*)
4. **Zulfiqar Ali**, Muhammad Imran, Wadood Abdul and Muhammad Shoaib, “**An Innovative Algorithm for Privacy Protection in a Voice Disorder Detection System**”, *Book Chapter in Biologically Inspired Cognitive Architectures (BICA) for Young Scientists*, Part of the Advances in Intelligent Systems and Computing book series, Springer International Publishing, vol. 636, pp. 228-233, 2018. (*ISI*)
5. **Zulfiqar Ali**, Mansour Alsulaiman, Ghulam Muhammad, Irraivan Elamvazuthi, Ahmed Al-nasheri, Tamer A. Mesallam, Mohamed Farahat, and Khalid H. Malki, “**Intra- and Inter-Database Study for Arabic, English, and German Databases: Do Conventional Speech Features Detect Voice Pathology?**”, *Journal of Voice*, vol. 31, no. 3, pp. 386.e1-386.e8, 2017. (*ISI-IF: 1.381*)
6. **Zulfiqar Ali**, Muhammad Imran, and Mansour Alsulaiman, “**An Automatic Digital Audio Authentication/Forensics System**”, *IEEE Access*, vol. 5, pp. 2994–3007, 2017. (*ISI-IF: 3.224*)
7. **Zulfiqar Ali**, Ghulam Muhammad, and Mohammed F. Alhamid, “**An Automatic Health Monitoring System for Patients Suffering from Voice Complications in Smart Cities**”, *IEEE Access*, vol. 5, pp. 3900-3908, 2017. (*ISI-IF: 3.224*)
8. Tamer A. Mesallam, Mohamed Farahat, Khalid H. Malki, Mansour Alsulaiman, **Zulfiqar Ali**, Ahmed Al-nasheri, Ghulam Muhammad, “**Development of Arabic Voice Pathology Database (AVPD) and Its Evaluation by using Speech Features and Machine Learning Algorithms**”, *Journal of Healthcare Engineering*, vol. 2017, Article ID 8783751, 13 pages, 2017. (*ISI-IF: 0.925*)
9. **Zulfiqar Ali**, Muhammad Talha and Mansour Alsulaiman, “**A Practical Approach: Design and Implementation of a Healthcare Software for Screening of Dysphonic Patients**”, *IEEE Access*, vol. 5, pp. 5844 - 5857, 2017. (*ISI-IF: 3.224*)
10. Ghulam Muhammad, Mansour Alsulaiman, **Zulfiqar Ali**, Tamer A. Mesallam, Mohamed Farahat, Khalid H. Malki, Ahmed Al-nasheri, and Mohamed A. Bencherif, “**Voice Pathology Detection using Interlaced Derivative Pattern on Glottal Source Excitation**”, *Biomedical Signal Processing and Control*, Vol. 31, Pages 156–164, 2017. (*ISI-IF: 2.214*)
11. Muhammad Imran, **Zulfiqar Ali**, Sheikh Tahir Bakhsh, Sheeraz Akram, “**Blind Detection of Copy-Move Forgery in Digital Audio Forensics**”, *IEEE Access*, vol. 5, pp. 12843 – 12855, 2017. (*ISI-IF: 3.224*)

12. Wadood Abdul, **Zulfiqar Ali**, Sanaa Ghouzali, Budour ALfawaz, Ghulam Muhammad and M. Shamim Hossain, “**Biometric Security Through Visual Encryption for Fog Edge Computing**”, *IEEE Access*, vol. 5, pp. 5531 – 5538, 2017. *(ISI-IF: 3.224)*
13. Ahmed Al-nasheri, Ghulam Muhammad, Mansour Alsulaiman, **Zulfiqar Ali**, Tamer A. Mesallam, Mohamed Farahat, Khalid H. Malki, and Mohamed A. Bencherif, “**An Investigation of Multidimensional Voice Program Parameters in Three Different Databases for Voice Pathology Detection and Classification**”, *Journal of Voice*, vol. 31, no. 1, pp. 113.e9–113.e18, 2017. *(ISI-IF: 1.381)*
14. Ahmed Al-nasheri, Ghulam Muhammad, Mansour Alsulaiman, **Zulfiqar Ali**, “**Investigation of Voice Pathology Detection and Classification on Different Frequency Regions Using Correlation Functions**”, *Journal of Voice*, vol. 31, no. 1, pp. 3-15, 2017. *(ISI-IF: 1.381)*
15. Ahmed Al-nasheri, Ghulam Muhammad, Mansour Alsulaiman, **Zulfiqar Ali**, Khalid H. Malki, Tamer A. Mesallam, and Mohamed Farahat, “**Voice Pathology Detection and Classification using Auto-correlation and entropy features in Different Frequency Regions**”, *IEEE Access*, 2017. DOI: 10.1109/ACCESS.2017.2696056 *(ISI-IF: 3.224)*
16. **Zulfiqar Ali**, Irraivan Elamvazuthi, Mansour Alsulaiman, Ghulam Muhammad, “**Detection of Voice Pathology using Fractal Dimension in a Multiresolution Analysis of Normal and Disordered Speech Signals**”, *Journal of Medical Systems*, Springer, vol. 40, no. 1, pp. 1-10, 2016. *(ISI-IF: 2.456)*
17. **Zulfiqar Ali**, Mansour Alsulaiman, Irraivan Elamvazuthi, Ghulam Muhammad, Tamer A. Mesallam, Mohamed Farahat, Khalid H. Malki, “**Voice Pathology Detection based on the Modified Voice Contour and SVM**”, *Biologically Inspired Cognitive Architectures (BICA)*, vol. 15, pp. 10-18, 2016. *(ISI-IF: 0.753)*
18. **Zulfiqar Ali**, Irraivan Elamvazuthi, Mansour Alsulaiman, Ghulam Muhammad, “**Automatic Voice Pathology Detection with Running Speech by Using Estimation of Auditory Spectrum and Cepstral Coefficients Based on the All-Pole Model**”, *Journal of Voice*, vol. 30, no. 6, pp. 757.e7–757.e19, 2016. *(ISI-IF: 1.381)*
19. Musaed Alhussein, **Zulfiqar Ali**, Muhammad Imran, Wadood Abdul, “**Automatic Gender Detection based on Characteristics of Vocal Folds for Mobile Healthcare System**”, *Mobile Information Systems*, vol. 2016, Article ID 7805217, 12 pages, 2016. *(ISI-IF: 1.462)*
20. Ghulam Muhammad, Ghadir Altuwaijri, Mansour Alsulaiman, **Zulfiqar Ali**, Tamer A. Mesallam, Mohamed Farahat, Khalid H. Malki, Ahmed Al-nasheri, “**Automatic Voice Pathology Detection and Classification using Vocal Tract Area Irregularity**”, *Biocybernetics and Biomedical Engineering*, vol. 36, no. 2, pp. 309-317, 2016. *(ISI-IF: 0.808)*
21. **Zulfiqar Ali**, Ghulam Muhammad, Mansour Alsulaiman, Irraivan Elamvazuthi and Khalid Al-Mutib, “**Oriented and Interpolated Local Features for Speech Recognition of Vocal Fold Disordered Patients**”, *International Journal of Computers and Their Applications (IJCA)*, vol. 22, no. 1, 2015.
22. Mansour Alsulaiman, Ghulam Muhammad, Mohamed A. Bencherif, Awais Mahmood, **Zulfiqar Ali**, “**KSU Rich Arabic Speech Database**”, *Information journal*, pp. 4231- 4253, vol. 16, issue (6B), June 2013.
23. **Zulfiqar Ali**, M. Aslam, M. E. Ana María, E. Gonzalo, “**Text-Independent Speaker Identification Using VQ-HMM Model Based Multiple Classifier System.**”, *Book Chapter in Advance in Soft Computing, Part of Lecture Notes in Computer Science Book Series, Springer International Publishing*, vol. 6438, pp.116-125, 2010. *(ISI)*

INTERNATIONAL CONFERENCE PUBLICATIONS

24. **Zulfiqar Ali**, Mansour Alsulaiman, Ghulam Muhammad, Ahmed Al-nasheri, Awais Mahmood, “**Clinical Informatics: Mining of Pathological Data by Acoustic Analysis**”, *International Conference on Informatics, Health & Technology*, pp. 1-8, 21-23 Feb, 2017. *(Indexed in Web of Science)*
25. Ahmed Al-nasheri, **Zulfiqar Ali**, Ghulam Muhammad, Mansour Alsulaiman, “**An Investigation of MDVP Parameters for Voice Pathology Detection on Three Different Databases**”, *Proc. of INTERSPEECH’15*, pp. 2952-2956, Sep 6-10, 2015. *(Indexed in Web of Science)*

26. Mohammed Algabri, Mansour Alsulaiman, Ghulam Muhammad, Mohammed Zakariah, Mohamed Bencherif, **Zulfiqar Ali**, **“Voice and Unvoiced Classification Using Fuzzy Logic”**, *19th International Conference on Image Processing, Computer Vision, & Pattern Recognition*, pp. 416-420, July 27-30, 2015.
27. I. Elamvazuthi, N.H.X. Duy, **Zulfiqar Ali**, S.W. Su, M.K.A. Ahamed Khan and S. Parasuraman, **“Electromyography (EMG) based Classification of Neuromuscular Disorders using Multi-Layer Perceptron”**, *Procedia Computer Science*, vol. 76, pp. 223-228, 2015.
28. I. Elamvazuthi, Zulika Zulkifli, **Zulfiqar Ali**, M.K.A. Ahamed Khan, S. Parasuraman, M. Balaji and M. Chandrasekaran, **“Development of Electromyography Signal Signature for Forearm Muscle”**, *Procedia Computer Science*, vol. 76, pp. 229-234, 2015.
29. Ahmed Al-nasheri, **Zulfiqar Ali**, Ghulam Muhammad, Mansour Alsulaiman, Khalid H. Almalki, Tamer A. Mesallam, Mohamed Farahat, **“Voice Pathology Detection with MDVP Parameters Using Arabic Voice Pathology Database”**, *5th IEEE National Symposium on Information Technology: Towards New Smart World*, pp. 1-5, Feb 16-18, 2015. *(Indexed in Web of Science)*
30. Ahmed A-Nasheri, **Zulfiqar Ali**, Ghulam Muhammad, and Mansour Alsulaiman, **“Voice Pathology Detection Using Auto-Correlation of Different Filters Bank”**, *11th ACS/IEEE International Conference on Computer Systems and Applications*, pp. 50-55, Nov 10-13, 2014. *(Indexed in Web of Science)*
31. **Zulfiqar Ali**, Ghulam Muhammad, Mansour Alsulaiman, Irraivan Elamvazuthi and Khalid Al-Mutib, **“Automatic Speech Recognition for Dysphonic Patients by using Oriented Local Features”**, *27th International Conference on Computer Applications in Industry and Engineering*, pp. 269-274, Oct 13-15, 2014.
32. Mansour Alsulaiman, Hussein Obeidat, Saad Al-Kahtani, **Zulfiqar Ali**, Ghulam Muhammad, Afnan Al Hindi, Taha Alfakih, **“Pronunciation Errors of Non-Arab Learners of Arabic Language”**, *International Conference on Computer, Communication and Control, Technology*, pp. 270-275, Sep. 2014. *(Indexed in Web of Science)*
33. Ghulam Muhammad, **Zulfiqar Ali**, Mansour Alsulaiman, Khalid Almutib, **“Vocal Fold Disorder Detection by applying LBP Operator on Dysphonic Speech Signal”**, *2nd International Conference on Intelligent Control, Modelling and Systems Engineering*, 29-31 Jan., 2014.
34. Mansour Alsulaiman, **Zulfiqar Ali**, Ghulam Muhammad, M. A. Bencherif, Awais Mahmood, **“KSU Speech Database: Text Selection, Recording and Verification”**, *7th European Modelling Symposium on Mathematical Modelling and Computer Simulation*, pp. 237-242, Nov. 20-22, 2013. *(Indexed in Web of Science)*
35. **Zulfiqar Ali**, Mansour Alsulaiman, Ghulam Muhammad, Tamer Mesallam, Irraivan Elamvazuthi, **“Vocal Fold Disorder Detection based on Continuous Speech by using MFCC and GMM”**, *7th IEEE GCC Conference and Exhibition*, pp. 384-289, 17-20 Nov. 2013. *(Indexed in Web of Science)*
36. Mansour M. Alsulaiman, Ghulam Muhammad and **Zulfiqar Ali**, **“Classification of Vocal Fold Diseases Using RASTA-PLP”**, *2013 International Conference on Bioinformatics & Computational Biology*, July 22-25, 2013.
37. Mohamed A. Bencherif, Mansour Alsulaiman, Ghulam Muhammad, **Zulfiqar Ali**, Awais Mahmood, Mohamed Faisal, **“Gender Effect in Trait Recognition”**, *International Conference on Signal Processing and Image Engineering*, 24-26 Oct, 2012.
38. Mohamed A. Bencherif, Mansour Alsulaiman, Ghulam Muhammad, Ghassan H. Al Shatter, Saad A. Al-Kahtani, **Zulfiqar Ali** and Mohammed Al-Gabri, **“Automatic Identification of Arabic L2 Learners Origin”**, *International Symposium on Automatic Detection of Errors in Pronouncing Training*, IS ADEPT 2012, pp. 107-112, June 6-8, 2012.
39. Mansour Alsulaiman, **Zulfiqar Ali** and Ghulam Muhammad, **“Voice Intensity Based Gender Classification by Using Simpson’s Rule with SVM”**, *IEEE 19th International Conference on Systems, Signals and Image Processing, IWSSIP 2012*, pp. 552-555, April 11-14, 2012,
40. Mansour Alsulaiman, **Zulfiqar Ali** and Ghulam Muhammad, **“Gender Classification with Voice Intensity”**, *IEEE UKSim 5th European Symposium on Computer Modeling and Simulation*, pp. 205-209, Nov 16-18, 2011. . *(Indexed in Web of Science)*

Science)

41. Ghulam Muhammad, Mansour Alsulaiman and **Zulfiqar Ali**, “**Comparison of Voice Features for Arabic Speech Recognition**”, *6th IEEE International Conference on Digital Information Management (ICDIM)*, pp. 303-308, Sep 26-28, 2011.
42. Mansour Alsulaiman, Ghulam Muhammad, Mohammed A. Alomari, Mohammed A. Alshehri, **Zulfiqar Ali** and Awais Mahmood, “**An Automatic Diagnostic System for Medically Disordered Voice**”, *The International Conference on Image Processing, Computer Vision, & Pattern Recognition (ICCV’11)*, July 18-21, 2011.
43. Ghulam Muhammad, Mansour Alsulaiman, Awais Mahmood and **Zulfiqar Ali**, “**Automatic Voice Disorder Classification using Vowel Formants**”, *IEEE International Conference on Multimedia and Expo (ICME 2011)*, pp. 1-6, July 11-15, 2011. . (*Indexed in Web of Science*)
44. Mansour Alsulaiman, Ghulam Muhammad, Mohamed A. Bencherif, Awais Mahmood, **Zulfiqar Ali** and Mohammad Aljabri, “**Building a Rich Arabic Speech Database**”, *IEEE 5th Asia International Conference on Mathematical Modeling and Computer Simulation (AMS ’11)*, pp. 100-105, May 23, 2011.
45. **Zulfiqar Ali**, Aslam Muhammad, Martinez Enriquez A. M., “**A Speaker Identification System using MFCC Features with VQ Technique**”, *IEEE 3rd International Conference on Intelligent Information Technology Application*, vol. 3, pp 115-118, Nov 2009. (*Indexed in Web of Science*)

ORGANIZED WORKSHOPS

1. Arif Mahmood Bhatti, **Zulfiqar Ali**, **Advance Workshop on MuPAD (a computer algebra system)**, LUMS *2nd International Conference on Mathematics and its Applications in Information Technology*, March 9-12, 2008.
2. Arif Mahmood Bhatti, **Zulfiqar Ali**, **Workshop on MuPAD (a computer algebra system)**, LUMS *1st International Conference on Mathematics and its Application in Information Technology*, November 27 -30, 2005.

ATTENDED SUMMER COURSES/TRAININGS /WORKSHOPS/CONFERENCES

1. **Professional Training Workshop on Multimedia Forensics**, Center of Excellence in Information Assurance (CoEIA), King Saud University, Saudi Arabia, May 2014.
2. **Advances in Probabilistic Modeling for Pattern Recognition**, 19th Summer School in Novel Computing, University of Eastern Finland, June 18-21, 2012.
3. **11th Faculty Development Workshop**, COMSATS Institute of Information Technology, Wah, Pakistan, July 30 – Aug 11, 2007.
4. **7th IEEE GCC Conference and Exhibition**, Nov. 17-20, 2013, Doha, Qatar.
5. **International Conference on Signal Processing and Image Engineering**, 24-26 Oct 2012, USA.
6. **International Symposium on Automatic Detection of Errors in Pronouncing Training (IS ADEPT)**, June 6-8, 2012, Stockholm, Sweden.
7. **19th IEEE International Conference on Systems, Signals and Image Processing (IWSSIP)**, April 11-14, 2012, Vienna, Austria.
8. **5th IEEE UKSim European Symposium on Computer Modeling and Simulation**, Nov 16-18, 2011, Madrid, Spain.

ABSTRACT OF PHD THESIS

Vocal fold disorder detection and classification methods are generally developed by using speech signals of sustained vowel and running speech. Current disorder detection methods for sustained vowel based on long-term features such as shimmer and jitter are unreliable due to non-periodicity of disordered signal and presence of significant noise components; hence, resulted into low accuracy. Moreover, sustained vowel is heavily dependent on the source; therefore, some frequency bands may contribute more for accurate detection of disorder. In this research, a disorder detection method (DMSV-FQA) by using long-term fractal dimension for sustained vowel is proposed to investigate the frequency bands. The experiments are

performed by using the MEEI vocal fold disorder database containing 226 subjects, and an accuracy of 91.28% is obtained for the lower band with a single feature. The overall highest accuracy of the method is 94.71%. Most of the existing methods for running speech use voice activity detection (VAD) module to detect and classify the vocal fold disorders. However, the VAD module has a limitation in terms of accuracy. Moreover, current methods use MFCC, which is not good for disorder classification and it depends on single human auditory principles (HAP). In addition, the current classification methods can only discriminate between fewer types of disorders and provide very low accuracy. In this research, two methods DMRS-HAP and CMRS-HAP by using running speech for detection and classification of the vocal fold disorders are proposed. In the proposed methods, the features are computed by using three HAP to get good accuracy for the detection as well as classification method. Moreover, the proposed methods are independent of VAD module. All experiments for both methods are conducted by using the same 226 subjects of the MEEI database. An accuracy of 98.22% is obtained for the DMRS-HAP, and it provides a clear visual evidence for the presence of a vocal fold disorder. The CMRS-HAP is able to differentiate between five different types of vocal fold disorders, and the best obtained classification accuracy is 93.33%. The results of the proposed methods show improved performance compared to the existing methods.

PERSONAL DATA

▪ Name	Zulfiqar Ali
▪ Father Name	Abdul Sattar
▪ Date of Birth	14 August, 1979.
▪ Religion	Islam
▪ Marital Status	Married
▪ Nationality	Pakistani

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REFERENCES

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 Department of Computer Science and Engineering,
 University of Engineering and Technology (UET),
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