

IV. CONCLUSION

Based on the purpose of this study, which is to find out how far the impact of distortion effects on sound recordings as part of anti-forensic activities, it can be concluded that from the three types of distortions used in this study, they get types of distortions that are effective in manipulating the authenticity of sound recordings and types of distortions that can still be recognized for their authenticity. From the test results in this study, the types of Distortions of Hard Clipping and Odd Harmonics with controls range high parameters can manipulate sound recordings with a percentage of 91% and 93%, respectively, making it difficult to recognize the authenticity of a sound recording. Unlike the case with the type of Hard Overdrive distortion with controls range parameters high – low and Hard Clipping and Odd Harmonics with low – medium controls parameters, with percentages of 92%, 88%, and 84% respectively for hard overdrive then a percentage of 94% and 87% for hard clipping, respectively, and a percentage of 89% and 80% for odd harmonics, respectively, that the results of the Anova analysis prove that sound recordings can still be identified. With the use of the Anova method in analyzing formants in this study, the recognition accuracy rate reached 95%. For further work, it is quite possible to use other audio data processing applications, as is the case with Audacity. Because, by using other audio data processing applications, it can find variations of other audio effects and different control parameter variables.

REFERENCES

- [1] K. Conlan, I. Baggili, and F. Breitingner, "Anti-forensics: Furthering digital forensic science through a," *DFRWS 2016 USA - Proc. 16th Annu. USA Digit. Forensics Res.*, vol. 18, p. S66–S75, 2015.
- [2] J. Sarwono, M. I. Mandasari, and Suprijanto, "Forensic Speaker Identification: An experience in Indonesians court," *20th Int. Congr. Acoust. 2010, ICA 2010 - Inc. Proc. 2010 Annu. Conf. Aust. Acoust.Soc.*, vol. June 2015, p. 3861–3863, 2010.
- [3] S. Jadhav, R. Patole, and P. Rege, "Audio Splicing Detection using Convolutional Neural Network," *2019 10th Int. Conf. Comput. Commun. Netw. Technol. ICCCNT 2019*, pp. 1-5, 2019.
- [4] Zhao, Hong and Chen, Yifan and Wang, Rui and Malik, Hafiz, "Anti-Forensics of Environmental-Signature-Based Audio Splicing Detection and Its Countermeasure via Rich-Features Classification," *IEEE Transactions on Information Forensics and Security*, vol. 11, pp. 1603-1617, 2016.
- [5] R. K. Chan, "Speaker discrimination: Citation tones vs. coarticulated tones," *Speech Commun*, vol. 117, no. June 2019, pp. 38-50, 2020.
- [6] Ali, Zulfiqar and Imran, Muhammad and Alsulaiman, Mansour, "An Automatic Digital Audio Authentication/Forensics System," *IEEE Access*, vol. 5, pp. 2994-3007, 2017.
- [7] Li, Xiaowen and Yan, Diqun and Dong, Li and Wang, Rangding, "Anti-Forensics of Audio Source Identification Using Generative Adversarial Network," *IEEE Access*, vol. 7, pp. 184332-184339, 2019.
- [8] A. B. Baskoro, N. Cahyani, and A. G. Putrada, "Analysis of Voice Changes in Anti Forensic Activities Case Study: Voice Changer with Telephone Effect," vol. 6, pp. 64-77, 2020.
- [9] Rusydi Umar, Sunardi Sunardi, Muhammad Fauzan Gustafi, "Analisis Statistik Manipulasi Pitch Suara Menggunakan Audio Forensik Untuk Bukti Digital," *Jurnal Mobile and Forensics (MF)*, vol. 1, no. 1, pp. 1-12, 2019.
- [10] Y. Azzery, "ANALISIS STATISIK PERBANDINGAN MANIPULASI SUARA DAN SUARA ASLI MENGGUNAKAN TEKNIK AUDIO FORENSIK," *teknokom*, vol. 3, no. 1, p. 29–33, 2020.
- [11] Tao, B., Wang, R., Yan, D., & Jin, C, "Anti-Forensics of Double Compressed MP3 Audio," *International Journal of Digital Crime and Forensics (IJDCF)*, vol. 12, no. 3, pp. 45-57, 2020.
- [12] M. Imran, Z. Ali, S. T. Bakhsh and S. Akram, "Blind Detection of Copy-Move Forgery in Digital Audio Forensics," *IEEE Access*, vol. 5, pp. 12843-12855, 2017.
- [13] Qamhan, Mustafa A. and Altaheri, Hamdi and Meftah, Ali Hamid and Muhammad, Ghulam and Alotaibi, Yousef Ajami, "Digital Audio Forensics: Microphone and Environment Classification Using Deep Learning," *IEEE Access*, vol. 9, pp. 62719-62733, 2021.
- [14] H. M. Jr, "Analisis Perbandingan Suara Menggunakan Metode Forensik Berdasarkan Formant Dengan Media Rekam Jam Tangan," 2016.

- [15] A. Team, "manual.audacityteam.org," 16 November 2021. [Online]. Available: <https://manual.audacityteam.org/man/distortion.html>. [Accessed 2 July 2022].
- [16] S. Nercessian, A. Sarroff and K. J. Werner, "Lightweight and Interpretable Neural Modeling of an Audio Distortion Effect Using Hyperconditioned Differentiable Biquads," *ICASSP 2021 - 2021 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, pp. 890-894, 2021.
- [17] M. N. Al-Azhar, *Digital Forensic : Panduan Praktis Investigasi Komputer*, Digital Fo., Jakarta: Salemba Infotek, 2012.
- [18] J. Zar, *Biostatistical Analysis*, Fifth edition, 2010.
- [19] Montgomery, Douglas C, *Design and Analysis* Eight Edition, 2013.
- [20] Murray Aitkin, Francis Brian, John Hindie, *Statistical Modelling in GLIM* Second Edition, 2005.
- [21] B.Deva, I.Mardianto, "Teknik Audio Forensik Menggunakan Metode Analisis Formant Bandwidth, Pitch dan Analisis Likelihood Ratio," *Ultimatics : Jurnal Teknik Informatik*, vol. 10, no. 2, pp. 67-72, 2019.