

Lecture Notes in Networks and Systems 1392


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Advancements in Generative Artificial Intelligence

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Contents

Analysis of Various Breakdown Voltage Improvement Techniques for E-mode AlGaN/GaN HEMTs	1
<i>Ravi Rathour and A. M. Khan</i>	
Speech Database Creation for Marathi Impaired Speech	14
<i>Lata More, Sakshi Paithane, and Ajay Paithane</i>	
Autonomous Mobile Robot with Enhanced Efficiency and Navigation Optimization in Restaurant Environment	24
<i>Sujit Sonawane, Aniket Jagzap, Mayur Kene, Soham Bhawar, and Sidhant Kulkarni</i>	
Recognition System for Discrete Facial Emotions Using Convolutional Neural Networks-CNN	39
<i>Amit S. Ufade and Vitthal J. Gond</i>	
Predicting Capsicum Leaf Diseases Using Machine Learning Technique	53
<i>Prashant B. Vikhe and Baisa L. Gunjal</i>	
Machine Learning-Based Dos Attack Detection Technique for Smart Grid Infrastructure	63
<i>Kamalesh Thoppaen Suresh Babu, Mital Patel, Rupali Attarde, and R. Mohan Kumar</i>	
Automatic Stability Studies Alert System for Pharmaceutical Formulations	76
<i>Madhur Kulkarni, Poorna Shankar, Soumitra Das, Chetan Sul, and Shubhankar Barhate</i>	
AI-Driven Plant Health Diagnostics	90
<i>Abhay Chopde, Roshan Thorat, Om Uikey, and Mayur Tidake</i>	
CST-YOLO7 to Enhanced Models for Detecting Soybean Diseases: A Statistical Analysis with CNN-SWIN Transformer and Backbone Architecture	101
<i>Prajakta P. Khaire, Ramesh D. Shelke, and Dilendra Hiran</i>	
Real-Time Sign Language Recognition Using Deep Learning Algorithms LSTM Neural Networks and MediaPipe Holistic	116
<i>Shrishail Patil, Ritesh Sah, Mrunali Rajkule, Akshada Bagul, and Swaliha Attar</i>	

Revolutionizing Industrial IoT: An Innovative Machine Learning Framework for Intelligent Signal Classification in Distributed Wireless Sensor Networks 125
Rakesh Thoppaen Suresh Babu, Kamalesh Thoppaen Suresh Babu, P.S.Kumaresh, and R. Mohan Kumar

Innovative Practices for Detecting Infections in X-Ray Images Using AI-Based Techniques 138
Rahulsingh G. Bisen, Archana M. Rajurkar, and Nikita S. Pande

Study on Potential of A.I. in Agriculture Sector in Indian Context: Opportunities and Challenges 152
Pooja S. Kawle, Dipashri H. Pawar, Sakshi S. Gadhave, Naid A. Daruwale, and Ritesh Patel

Revolutionizing Stroke Prediction Framework: A Deep Learning Approach Using Real-Time EEG Data 164
Venkat Namdev Ghodke, A. K. M. B. Hossain, Rakesh Thoppaen Suresh Babu, and R. Mohan Kumar

Deep Surveillance: Advancing Video Monitoring with Deep Learning 175
Vikas Chavan, Ashok Badade, Gaurav Badgujar, Vaibhav Deshmukh, and Rutik Dhamane

Ethanol-Powered Vehicles: Advancements in Flex-Fuel Technology and Supply Chain Integration 185
Yashraj Pravin Desale, Priya Rakibe, Rimzim Chark, and Jai Shah

Rotating Binaural Hearing System Probable Future in 3D Sound Source Localization 199
Vipin Vibhute, Yogesh Angal, and B. Surykanth

Comparative Study Based on Network Performance of Ddos Attacks in Cloud for Its Scientific and Commercial Solutions 212
Dhananjay Shripad Rakshe, Sweta Jha, Sachin K. Korde, and Pawan R. Bhaladhare

Enhancing Deepfake Detection with Dynamic Dataset, Dataset Optimization and Transition Point Detection 231
Sangita Lade, Ajinkya Sharad Tambe, Prathamesh Prabhakar Thakare, Gourav Balaji Suram, and Sujal Samir Bokariya

Comparative Analysis of Deep State-of-the-Art CNN Architectures Over Food-101 Dataset Using Transfer Learning and the Impact of Fine Tuning 243
Faisal Rasheed, Arshad Ahmad Dar, Sarfaraz Ahmad, and Gousiya Hussain

Real-Time Exercise Tracking: Leveraging Pose Estimation with MobileNetV2 Architecture 260
Prajakta Tate, Shreya Thorvat, Atharva Talaghatti, Roshani Raut, and Pradnya Borkar

Advanced IoT-Based Health Monitoring Systems: Enhancing Patient Care Through Real-Time Data, Predictive Analytics, and 5G-Enabled Connectivity 274
R. Dilip, G. Kavyashri, M. H. Nishchitha, N. Tejashwini, G. Madhura, and M. G. Manasa

Enhanced Dark and Light Channel Priors for Single-Image De-hazing 284
Parmeet Kaur and Sandhya Bansal

Analysis of Deep Learning Approaches in Biometric System 299
Seema Rani, Neeraj Mohan, and Priyanka Kaushal

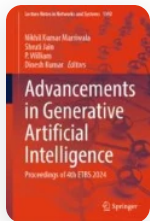
Author Index 311

[Home](#) > [Advancements in Generative Artificial Intelligence](#) > Conference paper

Analysis of Various Breakdown Voltage Improvement Techniques for E-mode AlGaIn/GaN HEMTs

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[Ravi Rathour](#)  & [A. M. Khan](#)

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Abstract

E-mode HEMTs featuring a p-GaN gate with 2D (2-dimensional) electron gas at the AlGa_N/Ga_N interface demonstrate a substantial density and exceptional mobility of carriers. This characteristic positions them as potential contenders for applications demanding both high frequency and high power. For high-power circuit applications, E-mode HEMTs with high breakdown voltage are desired, which have a significant influence on AlGa_N/Ga_N HEMT performance. From this perspective, even though several approaches for enhancing the breakdown voltage of E-mode HEMTs have been documented in literary works, the most promising approach for advancing circuit integration and device miniaturization in upcoming power electronics systems appears to be the recent approach involving E-mode HEMTs featuring a p-GaN gate with Ga_N/Al_N buffer layer reshaping. This innovative approach has demonstrated a remarkable breakdown voltage of up to 1781 V. The objective of this work is to comprehensively examine and analyze various methodologies designed to elevate the breakdown voltage in high-power E-mode HEMTs featuring a p-GaN gate. Initially, the underlying mechanisms accountable for breakdown are discussed. Subsequently, a concise overview of several approaches aimed at elevating the breakdown voltage in E-mode HEMTs is briefly mentioned. Finally, a novel approach that involves reshaping the hybrid Ga_N/Al_N buffer layer to increase the breakdown voltage in E-mode HEMTs featuring a p-GaN gate is discussed.

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