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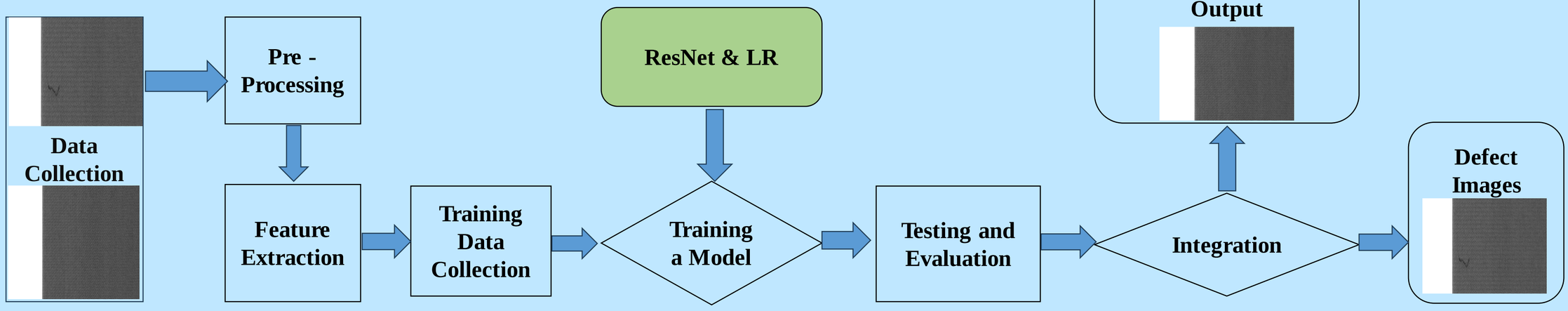
Synthetic Fiber Defects in Textiles are Detected using ResNet Compared with LR(Logistic Regression)

INTRODUCTION

- Effective defect detection plays a crucial role in the synthetic fiber production process as it directly impacts the quality of textiles. By addressing issues like broken ends, dimensional irregularities, and knots, manufacturers can ensure the production of high-quality fabrics.
- The research focuses on comparing the performance of two different models, ResNet and Logistic Regression, in defect detection. This analysis aims to determine their effectiveness in accurately identifying and categorizing defects, ultimately aiding in improving the overall defect detection process.
- ResNet is chosen as a model for defect detection due to its unique capability to capture intricate and subtle patterns in the data. Its advanced architecture enables it to differentiate between normal and defective fibers, providing reliable defect detection during the manufacturing stage.
- Logistic Regression is used to analyze defect patterns and characteristics, aiding in accurate defect detection and classification.
- The research aims to help textile manufacturers produce high-quality fabrics with fewer defects. The analysis of ResNet and Logistic Regression performances contributes to improved defect detection processes.
- The research emphasizes the importance of data-driven approaches in the textile industry. By evaluating different models, the research aims to advance defect detection techniques and enhance synthetic fiber production quality.

Synthetic Fiber Defects In Textiles

MATERIALS AND METHODS



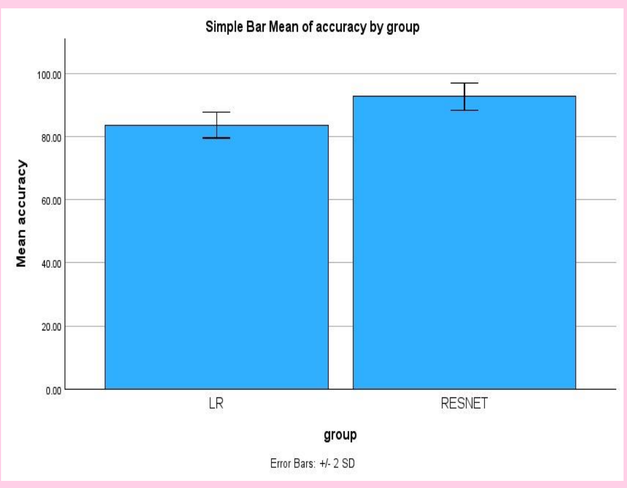
Synthetic Fiber Defect Detection In Textiles

RESULTS

- ResNet demonstrates robust performance for identifying defects in synthetic fiber materials by achieving an accuracy rate of 92.73%, showcasing its suitability for this task without relying on assumptions about data distribution.
- The high accuracy rate of ResNet highlights its effectiveness in utilizing neighboring data points to accurately detect defects in synthetic fiber production, making it a valuable tool for textile manufacturers in improving fabric quality and reducing defects.
- Logistic Regression (LR) achieves a practical accuracy rate of 83.67% and provides insights into direct relationships between variables.
- However, its lower accuracy emphasizes the importance of considering alternative models like ResNet for more precise defect predictions in synthetic fiber production.

Table presents Statistical Computation Values of Algorithms

Group Statistics					
	Group	N	Mean	Std. Deviation	Std. Error Mean
ACCURACy	ResNet	20	92.7380	2.14472	0.67822
	LR	20	83.6750	2.03773	0.64439



Accuracy Comparison between LR and ResNet

DISCUSSION AND CONCLUSION

- The T-test statistical analysis indicates a significant difference between group 1 and group 2, with a p-value of 0.045. This confirms that ResNet outperforms the Linear Regression model in detecting synthetic fiber defects.
- ResNet model demonstrated superior accuracy, averaging at 2.14% ± SD compared to Linear Regression model's 2.0% ± SD. This accuracy gap is significant in achieving high-quality products and addressing quality assurance issues.
- Linear Regression's limitations become apparent when capturing nonlinear relationships between input features and defects in synthetic fibers. Advanced models like ResNet excel at identifying and classifying complex defects by effectively capturing intricate patterns and adapting to various data distributions.
- ResNet's novel architecture with skip connections allows for effective training and improved performance of deep neural networks. It captures intricate patterns, making it an ideal model for computer vision tasks.
- ResNet's superior performance in detecting synthetic fiber defects is invaluable for textile manufacturers. It ensures high-quality products and minimizes quality assurance issues.
- The research contributes to advancements in deep learning for the textile industry. By evaluating different models for defect detection, the study highlights the importance of leveraging advanced machine learning techniques to enhance textile quality.

BIBLIOGRAPHY

- Chen, Zhiqiang, Jiehang Deng, Qiuqin Zhu, Hailun Wang, and Yi Chen. 2022. “A Systematic Review of Machine-Vision-Based Leather Surface Defect Inspection.” Electronics 11 (15): 2383.
- Damayanti, Damayanti, Latasya Adelia Wulandari, Adhanto Bagaskoro, Aditya Rianjanu, and Ho-Shing Wu. 2021. “Possibility Routes for Textile Recycling Technology.” Polymers 13 (21): 3834.
- Lin, Zesheng, Hongxia Ye, Bin Zhan, and Xiaofeng Huang. 2020. “An Efficient Network for Surface Defect Detection.” NATO Advanced Science Institutes Series E: Applied Sciences 10 (17): 6085.
- Lu, Bingyu, and Biqing Huang. 2023. “A Texture-Aware One-Stage Fabric Defect Detection Network with Adaptive Feature Fusion and Multi-Task Training.” Journal of Intelligent Manufacturing, March, 1–14.
- Nowrin, Afsana, Sharmin Afroz, Md Sazzadur Rahman, Imtiaz Mahmud, and You-Ze Cho. n.d. “Comprehensive Review on Facemask Detection Techniques in the Context of Covid-19.” Accessed January 24, 2024. https://ieeexplore.ieee.org/abstract/document/9496661/.
- Wen, Hao, Chang Huang, and Shengmin Guo. 2021. “The Application of Convolutional Neural Networks (CNNs) to Recognize Defects in 3D-Printed Parts.” Materials 14 (10): 2575.