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National Conference on Computational Intelligence and Applications

NC2IA- 2k25

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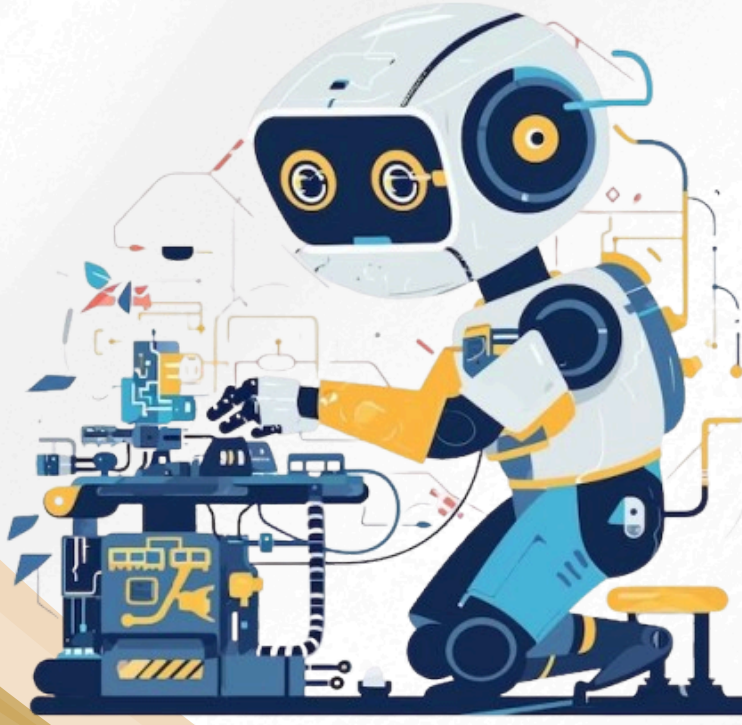

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Digital Transformation in E-commerce: An Empirical Analysis of Customer Behaviour and Marketing Performance Using Machine Learning Approaches

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Abstract

The rapid digitization of commerce has fundamentally transformed customer behaviour patterns and marketing effectiveness. This research presents a comprehensive empirical analysis of e-commerce customer behaviour and digital marketing performance using machine learning methodologies applied to 85,734 customers across multiple geographic regions. The study employs descriptive, predictive, and prescriptive analytics to address three critical research questions regarding customer lifetime value predictors, digital marketing channel effectiveness, and AI-driven personalization impact. The methodology integrates K-means clustering for customer segmentation, ensemble machine learning for predictive modelling, and comprehensive channel attribution analysis. Key findings reveal five distinct customer segments with CLV prediction models achieving $R^2 = 0.874$ and churn prediction models with 89.1% accuracy. Digital marketing analysis demonstrates ROI variations from 2.1:1 to 5.1:1 across channels, while AI-driven personalization yields 23.4% conversion rate improvements. The research provides empirically validated frameworks for customer segmentation, lifetime value prediction, and personalization optimization with immediate applicability for e-commerce practitioners.

Index Terms—E-commerce analytics, customer lifetime value, machine learning, digital marketing, personalization, customer segmentation