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Thesis Title: **Intelligent Model Framework on Business Management on Big Data Analytics in Cloud**

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Abstract

The contemporary business environment, increasingly influenced by data-driven innovation, necessitates the integration of Artificial Intelligence (AI), Big Data Analytics (BDA), and Cloud Computing for agile and intelligent decision-making. This Ph.D. research presents a technically rich framework that utilizes these technologies to build scalable, real-time, and intelligent models targeting optimization of business processes in strategic planning, marketing, finance, and operations.

To address key challenges such as processing high-dimensional data in real time and understanding complex consumer behavior, the thesis integrates both linear (statistical) and non-linear (deep learning) modeling techniques. It systematically incorporates Industry 5.0 digital logic modules such as multiplexers, demultiplexers, and OR gates to design a computation-efficient pipeline for streamlining management workflows. Using the Kullback–Leibler Divergence algorithm, entropy-based comparisons are established.

A novel deep learning architecture titled "RegGRU-Opt" is proposed, leveraging Recurrent Neural Networks with Gated Recurrent Units (GRUs). The model is equipped with dropout regularization and L2 constraints, achieving a benchmark accuracy of ≈98%, and an AUC-ROC score nearing 99% on binary classification problems like sentiment analysis. This model proves capable of capturing semantic features in textual data using minimal preprocessing, making it

ideal for deployment in business intelligence tools. The research further proposes an ensemble stacking model designed to predict real-time consumer behavior patterns on social media. This ensemble aggregates multiple learners including decision trees, support vector machines, and gradient-based methods to improve generalization in volatile environments. The architecture is particularly optimized for deployment on cloud-based analytics systems, ensuring high throughput and reduced latency in prediction delivery.

The framework also addresses economic forecasting using a hybrid deep learning-statistical model—SARI-LSTM FlatConcat. It combines Seasonal ARIMA with exogenous variables (SARIMAX) and Long Short-Term Memory (LSTM) networks. This dual-module setup captures both linear seasonal patterns and complex nonlinear dependencies in Consumer Price Index (CPI) data, achieving an MSE of 0.01 and an R^2 score of 0.92, outperforming standard time-series models. Machine learning models such as Random Forest, Logistic Regression, and K-Means clustering are also utilized to segment consumers and evaluate marketing strategies. These models, combined with Exploratory Data Analysis (EDA) and rigorous statistical validation, form a comprehensive decision support ecosystem. Cloud-based deployment ensures elasticity, fault tolerance, and resource optimization.

This Ph.D. work presents a modular, extensible, and technically robust framework that enables businesses to transition toward intelligent automation, with promising applications in predictive analytics, customer engagement, and economic policy modeling. Future research directions include integration with real-time IoT data, addressing ethical AI implementation, and sector-specific model adaptation for enhanced impact in Industry 5.0 landscapes.