

Quantum-Inspired Sentiment Analysis for Predictive Brand Management

Aras Alpaslan
The British School Warsaw

Abstract—As digital communication ecosystems continue to expand, brand management increasingly relies on the ability to extract, interpret, and predict consumer sentiment from large and dynamic data sources. Conventional sentiment analysis models—based on classical machine learning and deep neural architectures—often face limitations in handling ambiguity, contextual entanglement, and non-linear emotional expressions embedded in natural language. This study introduces a quantum-inspired sentiment analysis framework designed to enhance predictive brand management through improved semantic representation and probabilistic reasoning. Drawing inspiration from quantum mechanics, the proposed model employs principles such as superposition, entanglement, and Hilbert space embeddings to represent sentiment as a probabilistic distribution of cognitive states rather than as discrete classifications. By integrating these quantum-inspired techniques with classical natural language processing (NLP) and machine learning models, the system captures contextual subtleties and sentiment overlaps that traditional models often overlook. Experimental evaluation on social media and brand communication datasets demonstrates that quantum-inspired embeddings outperform conventional word vectorization techniques in recognizing sentiment polarity shifts and predicting brand reputation trends. The study highlights how quantum probabilistic reasoning can improve the interpretability and foresight of brand perception models, allowing organizations to proactively manage reputation, customer engagement, and market positioning.

■ In an era characterized by digital interconnectivity and real-time communication, brand perception has become an ever-evolving construct shaped by continuous consumer interaction, online discourse, and social media narratives [4]. The exponential growth of user-generated content has transformed sentiment analysis into a strategic component of predictive brand management, enabling firms to anticipate market reactions, reputation risks, and consumer trends [7]. However, the increasing complexity of digital commu-

nication—where emotion, irony, and cultural nuance intertwine—poses significant challenges for classical analytical models.

Traditional sentiment analysis systems, grounded in machine learning and deep learning architectures, rely on vector-based representations of text (e.g., Word2Vec, BERT, or GloVe) that map linguistic features into linear or contextual embeddings [1]. While effective for pattern recognition, these methods often fail to capture the non-deterministic and context-dependent nature of human emotion, leading to oversimplified sentiment classification. Ambiguous statements, contradictory opinions, and multi-emotional expressions require a more nuanced interpretive frame-

Digital Object Identifier 10.62802/kq3bah77

Date of publication 13 11 2025; date of current version 13 11 2025