Revisiting the 2009 Research: The Use of Neural Networks and Genetic Algorithms for Traffic Control

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Abstract

In 2009, I presented a thesis titled *Desenvolvimento de Algoritmo para Controle de Tráfego Urbano Usando Redes Neurais e Algoritmos Genéticos*, which proposed a hybrid AI approach combining **neural networks** and **genetic algorithms** for urban traffic optimization. Despite receiving the **minimum passing grade (7/10)** due to academic skepticism, my research was based on **correct principles that have since been validated by modern AI advancements**. This paper revisits the study, demonstrating its foresight and relevance in the current era of deep learning.

1 Introduction

The late 2000s saw an increasing interest in artificial intelligence (AI) applications, particularly in optimizing complex systems such as urban traffic management. My 2009 thesis introduced an **adaptive AI-driven approach** using neural networks and genetic algorithms to **dynamically control traffic lights** based on real-time data. While the work was ultimately accepted, the minimal grade reflected **academic resistance to new AI ideas**, particularly regarding the **capability of neural networks to solve non-linearly separable functions such as XOR**.

2 Background & The XOR Misconception

One of the main criticisms I faced was the claim that **neural networks cannot solve XOR**, which is **incorrect**. This limitation applies **only to single-layer perceptrons** (as demonstrated by Minsky & Papert in 1969), whereas **multi-layer perceptrons (MLPs) trained with backpropagation can learn XOR and other non-linearly separable functions** (Rumelhart, Hinton, & Williams, 1986).

By 2009, it was well-established that multi-layer neural networks could solve XOR, and my research **leveraged these advancements appropriately**. The criticism received in my evaluation reveals a **disconnect between some academic reviewers and contemporary AI developments**.

3 Methodology: A Hybrid Approach

My proposed system integrated:

- **Multi-layer neural networks** for pattern recognition in traffic data.
- **Backpropagation training** to optimize network weights.
- **Genetic algorithms** to refine network architectures and adapt traffic models dynamically.

This hybrid approach aimed to **increase accuracy** in predicting traffic flow, adapting to changing conditions in real time.

4 Results & Validation

The system demonstrated:

- Improved decision-making efficiency compared to fixed-timing traffic lights.
- A reduction in **traffic congestion and delays** in simulated environments.
- Successful adaptation to real-world scenarios using **genetic optimization**.

Despite these positive results, my thesis was given a minimal passing grade, not due to methodological flaws but rather **due to outdated academic views on AI**.

5 Academic Resistance & AI Progress Since 2009

The grading of my research highlights how **academic resistance can slow progress in AI**. Since 2009:

- **Deep learning has become the standard** for AI research, proving the power of multi-layer networks.
- **Neural networks now solve complex real-world problems**, far beyond XOR.
- **AI-driven traffic optimization is widely researched**, validating my early approach.

Had my work been fully recognized, it could have contributed earlier to AI-based **traffic control solutions**, which are now actively explored in smart city initiatives worldwide.

6 Conclusion & Call for Recognition

This paper reaffirms that my 2009 research was scientifically valid and aligned with modern AI advancements. The **low grade was unjustified** and stemmed from **a misunderstanding of neural network capabilities**. I call for **recognition of this early work**, as well as an acknowledgment of the need for more **open-mindedness in academia** when evaluating forward-thinking research.

7 Next Steps

- Republishing this work in AI research forums such as **arXiv, ResearchGate, or Medium**.
- Presenting it as a case study on **academic bias in AI research**.
- Inviting AI researchers to **review and validate** the original findings.

This document serves as both a defense of past work and a call to action: **academic institutions must remain open to ideas that challenge outdated beliefs, or risk stalling progress**.