The BENN Architecture: A Scholarly Exploration of Biologically-Inspired Emotional Neural Networks

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Introduction

Artificial Intelligence has evolved rapidly over the past two decades, but its reliance on architectures such as Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), and Transformers has left the field with one enduring problem: the black box. Despite their success, these models are difficult to interpret, offering little insight into how or why decisions are made. The BENN (Biologically-inspired Emotional Neural Network) architecture style offers a new perspective, introducing concepts derived from affective neuroscience and human cognition. By incorporating biological functions such as emotion, reward, and perceptual embedding, BENN aims to make artificial neural systems more transparent and interpretable.

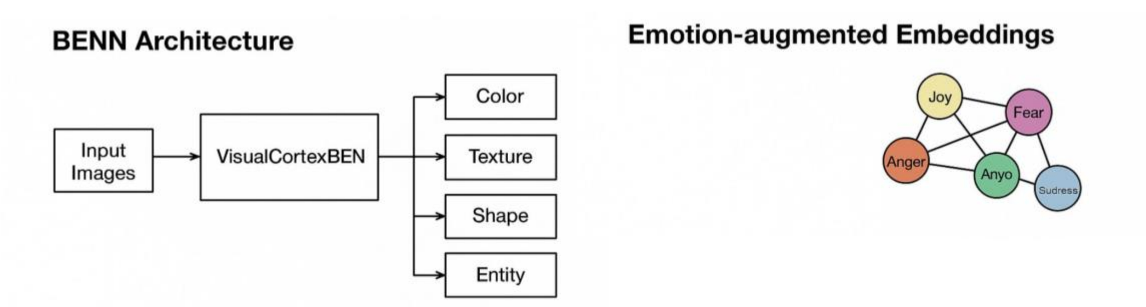

Figure 1. High-level BENN infographic: motivation, architecture sketch, and emotion-augmented embeddings.

The BENN Theory

BENN is rooted in the idea that human cognition is not purely logical or mathematical, but deeply interwoven with emotion and perception. In the brain, the visual cortex does not merely detect objects—it processes texture, color, symmetry, curvature, and complexity while integrating emotional and motivational states. BENN attempts to replicate this dynamic, embedding affective processing directly into the architecture of neural networks. This differs from conventional AI systems that focus narrowly on statistical pattern recognition.

This theory behind the BENN architecture did not emerge from the analysis of other neural architectures or any literature on the topic, but from my own conceptual framework that I used to develop a theory that paralleled the ones utilized in the 20th century to develop the first neural networks and deep learning machines. The reason other papers are not cited in this commentary is due to this reason alone.

By modeling such processes, BENN makes strides toward solving the black box problem. Rather than producing an opaque classification output, BENN models can expose internal emotional embeddings, attention maps, and centroid estimations, allowing researchers to visualize and understand what the network 'perceives' and how it evaluates features.

VisualCortexBENN as an Example

VisualCortexBENN is an applied instance of BENN theory. Its design simulates the hierarchical stages of human visual processing: low-level feature extraction, color and texture embedding, shape-emotion mapping, and centroid estimation. Together, these elements mimic processes observed in biological visual pathways.

For example, shape-emotion mapping in VisualCortexBENN parallels how humans find symmetry aesthetically pleasing, associate curvature with friendliness, or interpret complexity as a marker of novelty. Unlike CNNs or Transformers that treat all patterns as abstract data, VisualCortexBENN integrates these biologically grounded biases.

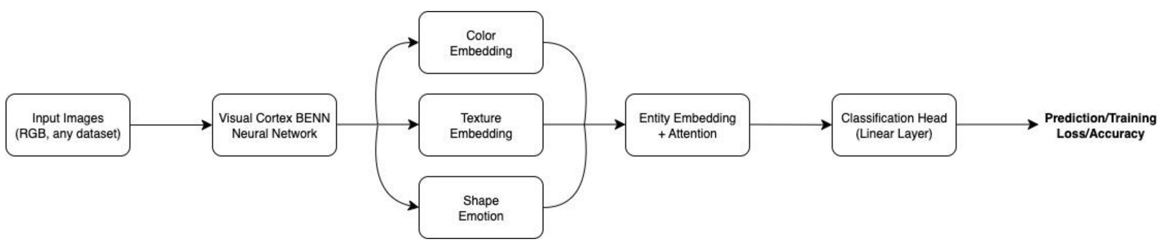

Figure 2. VisualCortexBENN workflow: input images → feature extraction → embeddings → classifier/training signals.

Why BENN is Different

The primary difference between BENN and traditional AI lies in its attempt to replicate not just the computational, but also the emotional and perceptual functions of the brain. CNNs excel at feature extraction, RNNs capture sequential data, and Transformers leverage attention. BENN introduces a new paradigm: embedding affect and biological constraints.

This means that BENN models not only provide outputs but also reveal their internal logic. They allow researchers to look inside the black box by exposing intermediate emotional and perceptual embeddings. This could radically improve trust, transparency, and collaboration between humans and AI systems.

Moreover, BENN is not limited to vision. Its architecture can expand into other domains of biology-inspired processing, such as auditory emotion recognition, decision-making under reward structures, and even higher-order psychological modeling. This makes BENN a fertile framework for advancing AI, neurology, and psychology together.

Applications and Future Directions

The potential applications of BENN are vast. In robotics, emotion-augmented vision systems could enable machines to respond more naturally to human cues. In cognitive science, BENN could provide testable models of human perception and affective reasoning. In psychology, it could help simulate disorders of perception and emotion, offering new avenues for therapeutic research.

The abundance of biological functions yet to be modeled—ranging from attention shifts, predictive coding, memory consolidation, and affective modulation—means that BENN is only at the beginning of its journey. By enabling researchers to replicate these processes, BENN could reshape our understanding of both artificial and biological intelligence.

Conclusion

The BENN architecture represents a bold step beyond the traditional limits of artificial neural networks. By embedding emotional and biological functions, BENN addresses the black box problem and lays the groundwork for interpretable, transparent, and human-like AI. VisualCortexBENN is one concrete example of this vision, demonstrating how texture, color, symmetry, and emotional mapping can be combined into a cohesive framework. Ultimately, BENN provides not only a computational tool but also a theoretical bridge between AI, neuroscience, and psychology.