

Contextual Coherence Graph Transformer (CCGT)

Teaching Computers How to Understand the Flow of Text

By: Nishant V.S – Vellore Institute of Technology

The Crux of Context: When Words Fail Logic



Reading Words

Computers are adept at processing individual words and syntax through language models.



Missing Cohesion

However, they often **fail to grasp the semantic glue**—the logical connection between adjacent sentences.

Consider this sequence:

“The cat chased the ball. The sun went to school.”

This demonstrates a clear **break in logical coherence** which traditional models often overlook. CCGT is designed to detect these precise breaks.

The "Glue" of Great Writing: Why Coherence is Essential

Coherence is the invisible "glue" that transforms a collection of data points into a clear, structured, and logical narrative. Its mastery is critical across various AI domains.

→ **Automated Assessment**
Enhances **essay and document scoring** by judging flow and structure, not just vocabulary.

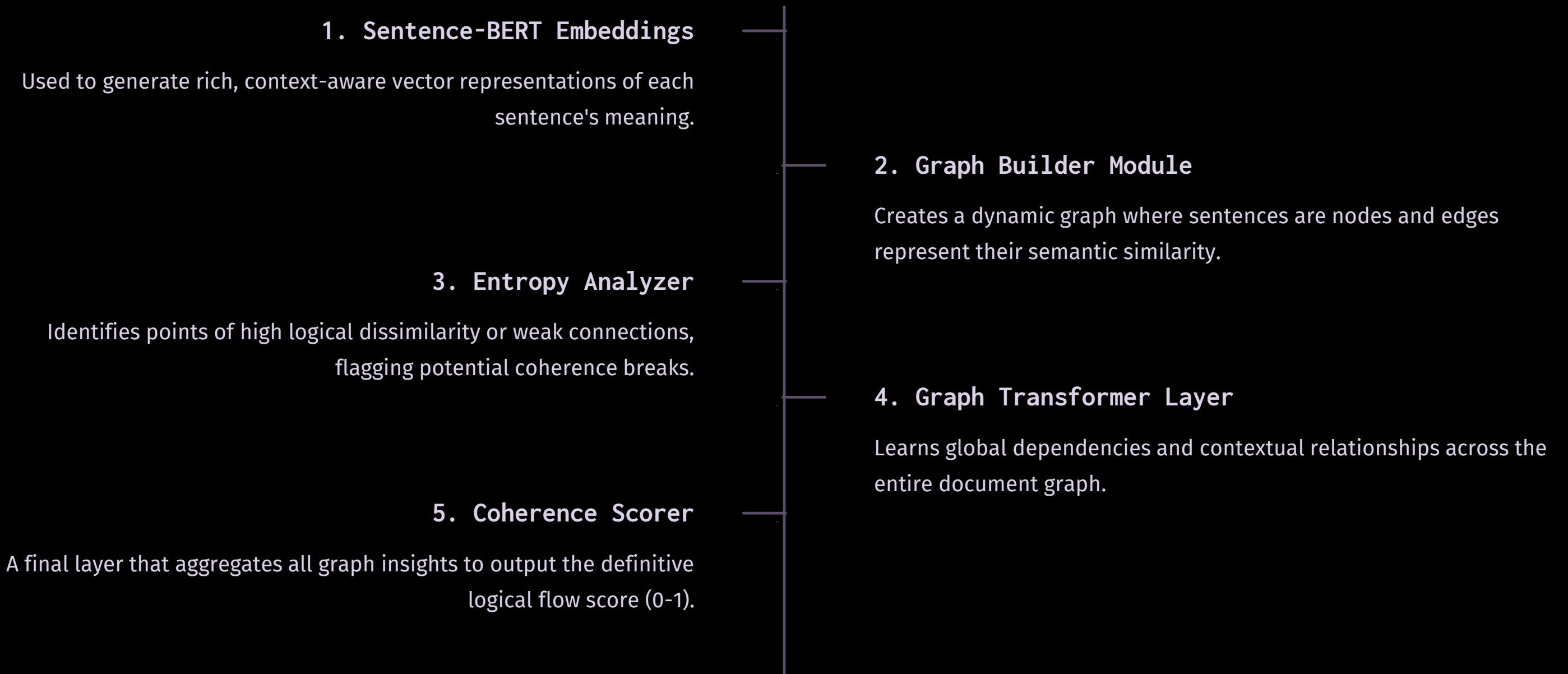
→ **Chatbot Evaluation**
Crucial for validating the logical progression and context maintenance in dialogue and **chatbot responses**.

→ **Content Generation**
Ensures **summarization and report generation** outputs are structured and readable, not just concatenated facts.

Coherence is the difference between random facts and structured, readable output from LLMs like ChatGPT.

CCGT's Core Engine: The Architecture

The CCGT leverages a multi-stage process integrating contemporary NLP techniques with graph processing for robust analysis.



Moving Beyond Words: Key Takeaways of CCGT



Flow, Not Just Facts

CCGT enables computers to comprehend the **meaning flow** and structural integrity of text, moving beyond simple word recognition.



Interdisciplinary Synthesis

It successfully integrates principles from Natural Language Processing, advanced Graph Theory, and modern AI architectures.



Broad Utility

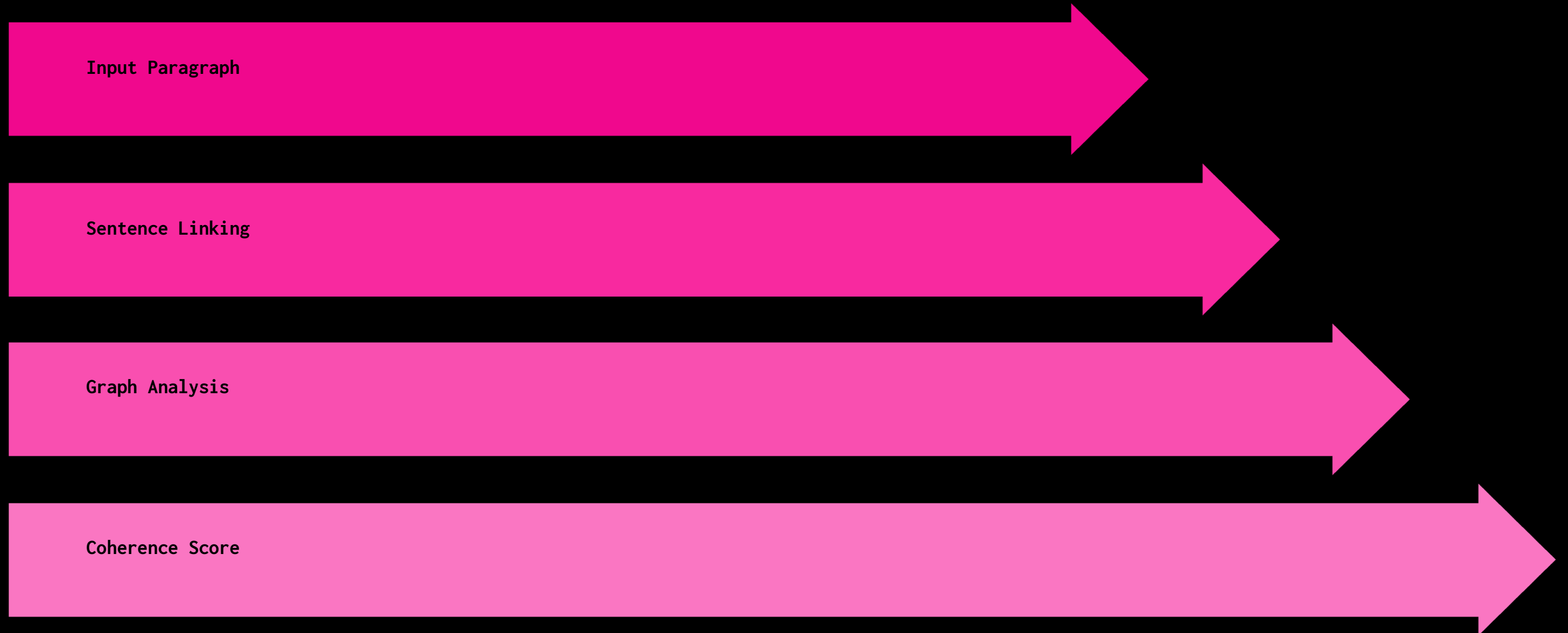
The framework offers practical applications across academic (EdTech), research, and high-demand enterprise scenarios.



Context-Aware AI

It represents a significant step toward developing AI systems that are inherently **more contextually aware** and logically sound.

What is CCGT? Contextual Coherence Graph Transformer



The Implementation Stack: Technologies Powering CCGT

Component	Technology
Frontend	React (Vite, Tailwind CSS, Recharts for dynamic visualisations)
Backend/API	FastAPI (Python, chosen for high performance and low latency)
Core Model	Fine-tuned Sentence-BERT integrated with the custom Graph Transformer module
Deployment	Vercel (Frontend Hosting), Render (Backend Service)

This modern, modular stack ensures scalability, rapid development, and optimal performance for the coherence analysis service.

Versatile Applications of Coherence Scoring

The ability to objectively measure text coherence opens up critical use cases in multiple high-impact sectors.



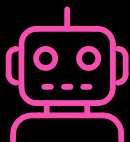
EdTech & Assessment

Enables automatic, objective feedback for student essays, grading on logical structure and flow.



Research & Publishing

Provides a quantitative metric for text quality evaluation in large datasets and academic submissions.



Advanced AI Validation

Acts as a quality control mechanism for Large Language Model (LLM) outputs, ensuring generated text is contextually sound.



Enterprise Document Management

Automates consistency and compliance checks across complex internal documentation and reports.

Visualising Coherence: The Frontend Dashboard

The user-facing application provides intuitive visualizations to illustrate CCGT's analysis process and final score.



Graph Visualization

Displays the graph structure, where node proximity and edge thickness illustrate semantic relatedness.



Sequential Coherence Chart

A line chart showing the coherence score of each sentence pair, highlighting where logical breaks occur.



Final Score Summary

A clear display of the aggregate coherence score for the entire input paragraph, enabling quick assessment.

📌 This integrated dashboard provides researchers and developers with detailed insights into the model's decision-making process.