
# Juss

## Advanced Arabic Poetry Web Application

Faisal Bin Hassan - Moaath Alahmadi - Mahmued Alardawi - Thamer Almalki

# Contents

Abstract ..... 3
Introduction ..... 3
Core Features ..... 3
  Poem Generation ..... 3
Verse-by-Verse Analysis ..... 3
  Adherence to Traditional Meters ..... 4
  Story Generation from Poems ..... 4
  Visual Representation with DALLE ..... 4
  Smart Arabic Poem Teacher ..... 4
Methodology ..... 4
  Poem Generation, Analysis, and Visual Representation ..... 4
  Retrieval-Augmented Generation (RAG) for the Smart Poetry Teacher ..... 5
Use Cases and Applications ..... 6
Technologies and Architecture ..... 6
  Core AI Models ..... 6
  Additional Frameworks ..... 7
  Architectural Overview ..... 7
  Technical Stack ..... 7
Results and Evaluation ..... 7
  Poem Generation from the Fine-Tuned Model ..... 7
  RAG Model for the Smart Teacher ..... 8
Conclusion ..... 9

# Abstract

The development of advanced technologies has ushered in a new era of creativity and educational tools, particularly in the realm of language and literature. Our project, an innovative web-based platform, is designed to generate, analyze, and assist in the creation of Arabic poetry by leveraging state-of-the-art artificial intelligence. This platform, named Juss, represents a significant step forward in integrating machine learning with the rich and complex traditions of Arabic poetry, blending classical poetic norms with modern computational power.


# Introduction

Juss employs the sophisticated ALLaM language model, tailored specifically to comprehend and generate Arabic poetry. This model is adept at producing high-quality poems that adhere to traditional metrics, ensuring linguistic and aesthetic fidelity. Additionally, the platform provides in-depth verse-by-verse analyses and overarching interpretations, aiding users in understanding poetic structures and meanings. One of its standout features is the ability to guide poets in aligning their work with the correct sea type (بحور الشعر), reinforcing traditional poetic rules and rhythmic patterns.

# Core Features

## Poem Generation

The application can generate complete Arabic poems based on user input, maintaining adherence to classical poetic metrics and linguistic quality. Leveraging the capabilities of ALLaM, the platform ensures that each generated piece reflects traditional structures and artistry intrinsic to Arabic poetry.


# Verse-by-Verse Analysis

Users can input their poems or other pieces for detailed analysis. The platform breaks down each verse, providing explanations of meaning, linguistic intricacies, and thematic elements. This facilitates a deeper understanding of poetic composition, guided by the processing power of ALLaM.

### Adherence to Traditional Meters

One of the defining features of Juss is its ability to guide users in composing poetry that conforms to the traditional Arabic poetic meters (بحور الشعر). The model helps poets align their verses with the correct rhythmic and metric patterns, ensuring fidelity to classical conventions.

### Story Generation from Poems

Expanding beyond analysis, Juss is equipped to create stories inspired by user-provided poems. These stories capture the themes and emotions embedded in the poetry, transforming them into cohesive narratives. This feature enriches creative writing and adds a new dimension to poetic interpretation.


### Visual Representation with DALLE

The platform incorporates DALLE to enable the generation of image slideshows that visually represent the themes and imagery in the verses. This provides users with an engaging way to experience their poetry through powerful, contextually aligned visual content.

### Smart Arabic Poem Teacher

The application includes a smart poetry assistant feature that can answer any question related to Arabic poetry. Utilizing Retrieval-Augmented Generation (RAG), this tool serves as an interactive learning companion, providing well-researched and informative responses to users' queries, thus enhancing their understanding and appreciation of poetic intricacies.


## Methodology

### Poem Generation, Analysis, and Visual Representation

1. **Data Preprocessing**: The platform begins with a comprehensive dataset comprising traditional Arabic poems. These poems undergo preprocessing to clean and normalize the text, ensuring consistency in diacritics and format. This step helps the model recognize and adhere to traditional poetic structures and linguistic norms.


2. **Model Training**: The **ALLaM** model is fine-tuned on this preprocessed data to specialize in understanding the nuances of Arabic poetry. Training involves learning both semantic and syntactic patterns specific to classical Arabic poetry, enabling the model to generate and analyze verses accurately.

3. **Poem Generation and Analysis Workflow**:
    - **User Input**: Users provide a topic, initial line, or complete poem.
    - **Model Processing**: **ALLaM** generates or analyzes the input, aligning with traditional meters and providing verse-by-verse insights.
    - **Feedback Loop**: The platform's feedback mechanism refines output quality based on user interactions, improving the model's response over time.

4. **Story and Visual Generation**: For story creation and image representation, **ALLaM** extracts themes from the poem and **DALLE** translates these themes into coherent visual content. This dual-model interaction ensures that generated stories and images resonate with the original poetic elements.

## Retrieval-Augmented Generation (RAG) for the Smart Poetry Teacher

1. **Integration of External Knowledge**: The smart poetry assistant leverages **Retrieval-Augmented Generation (RAG)** to pull relevant information from extensive databases and sources on Arabic poetry. This integration enriches the answers provided by the assistant, ensuring they are well-informed and detailed.

2. **Query Handling Workflow**:
    - **User Query**: The user poses a question related to Arabic poetry.
    - **Retrieval Process**: The RAG model searches for relevant context and information to support the response.
    - **Response Generation**: The system combines retrieved data with the processing capabilities of **ALLaM** to formulate comprehensive and informative answers.

# Use Cases and Applications

1. **Poets Seeking Guidance** Poets, whether novices or seasoned writers, can greatly benefit from **Juss**. The platform offers tools for generating high-quality poems that adhere to traditional Arabic poetic meters and provides detailed verse-by-verse analysis. This allows poets to refine their work and ensure it aligns with classical conventions, enriching their creative process.

2. **Educators and Students** Educators teaching the art and science of Arabic poetry, as well as students learning it, can use **Juss** as an educational resource. The Smart Arabic Poem Teacher, powered by **RAG**, can answer questions related to poetic meters, structures, and historical context, making it a valuable companion for studying علم العروض. Additionally, the platform's ability to analyze poems in-depth provides insights that aid in learning and teaching.

3. **Creative Writers** Writers looking to explore stories inspired by poetic themes can leverage the story generation feature. **Juss** transforms poems into cohesive narratives, capturing the embedded emotions and themes, which enhances the storytelling experience and provides inspiration for new creative works.

4. **Art and Presentation** Users interested in adding a visual dimension to their poetry can take advantage of the image slideshow feature powered by **DALLE**. This tool creates visual slideshows that align with the themes and emotions of the poem, offering an engaging way to present poetry in artistic formats. This feature is particularly useful for presentations, performances, or creating multimedia content.

5. **Lifelong Learners and Enthusiasts** Individuals passionate about Arabic poetry and its traditions will find **Juss** an excellent platform for exploration and self-study. The platform's comprehensive capabilities, including poem generation, analysis, and educational insights, make it suitable for anyone looking to deepen their understanding and appreciation of Arabic literature.

# Technologies and Architecture

## Core AI Models

- **ALLaM**: The primary language model responsible for generating, analyzing, and providing explanations for Arabic poetry. ALLaM is designed with a deep understanding of Arabic language complexities, enabling it to maintain traditional poetic structures and provide comprehensive analyses.
- **DALLE**: Used for creating visual representations that align with the poetic themes and imagery. DALLE's image generation capabilities enhance the platform's immersive experience by

translating verses into cohesive visual slideshows.

### Additional Frameworks

- **Retrieval-Augmented Generation (RAG)**: Integrated for the Smart Arabic Poem Teacher feature. RAG combines external knowledge retrieval with generative response formulation, enabling the system to answer complex poetry-related questions with depth and accuracy.

### Architectural Overview

The architecture of **Juss** is built on a modular approach that integrates several advanced AI frameworks:

- **Data Preprocessing Pipeline**: Ensures that input text is normalized and formatted for consistency, essential for training and generating accurate outputs.
- **Model Integration Layer**: Facilitates seamless interaction between **ALLaM** and **DALLE**, allowing for the smooth generation of text and corresponding visuals.
- **RAG Subsystem**: Handles the retrieval and synthesis of relevant information to power the Smart Poetry Teacher module, ensuring informed and context-aware responses.
- **User Interaction Interface**: Built with modern web technologies, it provides an intuitive user experience, enabling users to input data, receive generated poetry, ask questions, and view visual outputs.

### Technical Stack

- **Backend**: Python, Django, and IBM Watsonx for model training and deployment.
- **Frontend**: React, and Tailwind.
- **Database**: Utilizes SQL-based systems for storing user data and poetry content.
- **Cloud Infrastructure**: Supports scalable deployments and real-time processing for enhanced performance.

## Results and Evaluation

### Poem Generation from the Fine-Tuned Model

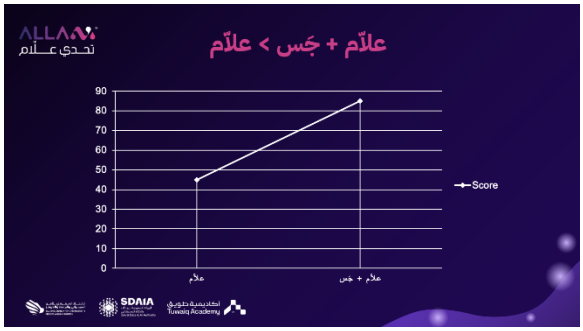
The fine-tuned **ALLaM** model's performance was measured using metrics like semantic similarity and adherence to traditional poetic structures. The model demonstrated strong capabilities in generating coherent and contextually accurate poetry that aligns with classical Arabic meters.

**Evaluation Metrics for Poem Generation**:

- **Semantic Similarity**: The generated poems were assessed for semantic similarity to ensure they maintained thematic relevance to the input

prompts. The model consistently achieved high scores, reflecting its effectiveness in capturing the intended meaning and poetic nuances.

- **Adherence to Poetic Meters**: The output was evaluated for alignment with traditional Arabic poetic meters, verifying the model's ability to produce rhythmically accurate verses.




**Challenges and Solutions**:

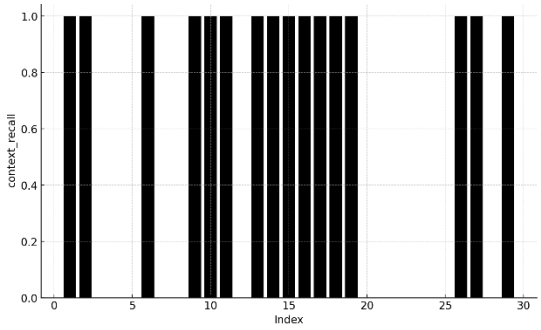
- **Training Data Quality**: Ensuring the dataset used for fine-tuning was representative of high-quality classical Arabic poetry was crucial. This was mitigated through extensive curation and preprocessing.
- **Model Overfitting**: To prevent overfitting, regularization techniques and validation checks were implemented during training.

## RAG Model for the Smart Teacher

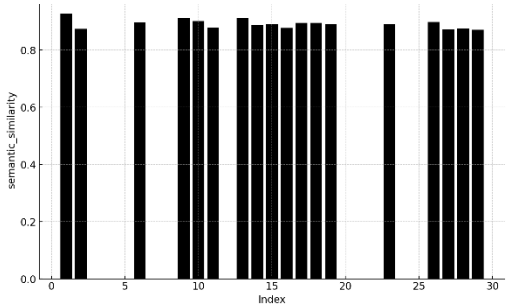
The **RAG** model, integrated for the Smart Arabic Poem Teacher feature, was evaluated based on context recall and response accuracy. This model's capability to retrieve relevant information and synthesize coherent, informative answers was a key focus.

**Evaluation Metrics for the RAG Model**:

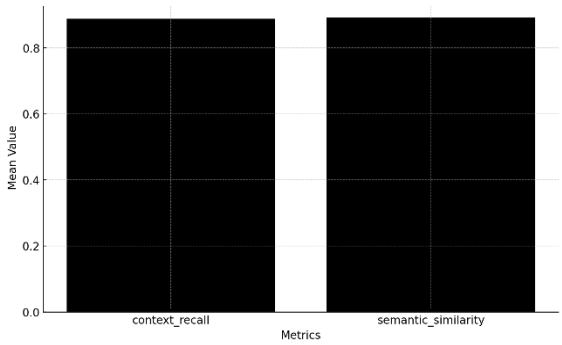
- **Context Recall**: The model's ability to accurately retrieve pertinent information from external sources was consistently high, demonstrating its proficiency in sourcing and incorporating contextual data.




- **Response Coherence**: The generated responses were evaluated for clarity and informativeness. User feedback indicated that the answers were well-structured and relevant to the questions posed.




- The **Mean** for both Context Recall and Response Coherence:




appreciation of Arabic poetry, preserving its cultural significance and adapting it to modern technological landscapes.

# Conclusion

The **Juss** project has made significant strides in blending traditional Arabic poetry with cutting-edge artificial intelligence, offering poets, educators, and enthusiasts an innovative platform for creation and learning. The fine-tuned **ALLaM** model has shown remarkable effectiveness in generating poetry that adheres to classical poetic structures, while the **RAG-powered Smart Teacher** feature provides comprehensive, contextually informed responses that enhance users' understanding of Arabic poetry.

Moving forward, potential future developments include expanding the dataset to encompass a wider range of poetic forms, incorporating user customization options for more personalized outputs, and improving the real-time response capabilities of the Smart Teacher. These enhancements will further solidify **Juss** as a versatile and indispensable tool for the study and