

AI Text Summarization Agent - Project Report

Project Details

Course: Deep Learning

Instructor: Dr. Asif Khan

Project: AI Text Summarization Agent

Group Members

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Executive Summary

This project is a web-based application that uses artificial intelligence to automatically summarize long texts. Users can paste any article, document, or text into the application, and the AI will generate a concise summary that captures the main points. The application is built using modern deep learning technology and provides an easy-to-use interface for anyone to summarize text quickly.

What is This Project?

Purpose

The AI Text Summarization Agent is designed to help people save time by automatically condensing long texts into shorter, more manageable summaries. Instead of reading through entire articles or documents, users can get the key information in just a few sentences.

Problem It Solves

- **Time Saving:** Reading long documents takes time. This tool summarizes them in seconds.
 - **Quick Understanding:** Get the main points without reading everything.
 - **Accessibility:** Anyone can use it - no technical knowledge required.
 - **Efficiency:** Perfect for students, researchers, professionals, or anyone who needs to process lots of text quickly.
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How Does It Work?

The Technology Behind It

The application uses a state-of-the-art AI model called **BART** (Bidirectional and Auto-Regressive Transformers). This is a deep learning model that was trained on millions of news articles to understand how to create good summaries.

Key Components:

1. **Web Interface:** Built with Streamlit - a user-friendly web framework
2. **AI Model:** BART transformer model from Facebook/Meta
3. **Deep Learning Framework:** Uses PyTorch and Transformers library
4. **Automatic Processing:** Handles text of any length automatically

The Process

When you use the application:

1. **Input:** You paste your text into the text box
 2. **Processing:** The AI model analyzes the text and identifies key information
 3. **Generation:** The model creates new sentences that summarize the content (not just copying - it actually generates new text)
 4. **Output:** You get a clean, readable summary with statistics
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Features

Main Features

1. Real AI Summarization

- Uses advanced deep learning technology
- Generates abstractive summaries (creates new sentences, not just extracts)
- Handles texts of any length automatically

2. User-Friendly Interface

- Simple, clean design
- No technical knowledge needed
- Clear instructions and feedback

3. Customizable Summary Length

- Adjust minimum and maximum summary length
- Control how detailed you want the summary to be

4. Automatic Model Management

- Downloads the AI model automatically on first use
- Caches the model for faster subsequent use
- No manual setup required

5. Summary Statistics

- Shows original text length
- Shows summary length
- Displays compression ratio (how much was condensed)

6. Example Text

- Includes sample article for quick testing
- Helps users understand how it works

Technical Details

Technologies Used

Technology	Purpose
Python 3.12	Programming language
Streamlit	Web interface framework
Transformers (Hugging Face)	AI model library
PyTorch	Deep learning framework
BART Model	Pre-trained summarization model

System Requirements

- **Python:** Version 3.8 or higher
- **Internet Connection:** Required for first-time model download (~1.6 GB)
- **Storage:** About 2 GB free space for model and dependencies
- **RAM:** 4 GB minimum (8 GB recommended)

Model Information

- **Model Name:** facebook/bart-large-cnn
 - **Type:** Transformer-based Encoder-Decoder
 - **Training Data:** CNN/DailyMail news articles
 - **Capabilities:** Abstractive text summarization
 - **Size:** Approximately 1.6 GB
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How to Use the Application

Step-by-Step Guide

1. Start the Application

- Open terminal/command prompt
- Navigate to project folder
- Activate virtual environment: `.\venv\Scripts\Activate.ps1`
- Run: `streamlit run streamlit_app.py`
- Browser opens automatically

2. Load the AI Model (First Time Only)

- Click "Load AI Model" button
- Wait for model to download (1-2 minutes, one-time only)
- You'll see "AI Model Ready!" when done

3. Enter Your Text

- Paste your article or text into the input box
- Or click "Load Example Article" to try with sample text
- Minimum 50 characters required

4. Adjust Settings (Optional)

- Use sliders in sidebar to set min/max summary length
- Default: 30-130 words works well for most cases

5. Generate Summary

- Click "Generate Summary" button
- Wait a few seconds for processing
- View your summary and statistics

6. Copy Results

- Summary is displayed in a highlighted box
- Click "Copy Summary to Clipboard" to get the text
- Statistics show compression ratio and word counts

Project Structure

```
ai-text-summarization/
├── streamlit_app.py          # Main application file
├── requirements.txt          # Python package dependencies
├── README.md                 # Quick start guide
├── PROJECT_REPORT.md         # This report
├── project-docs/             # Detailed documentation
│   ├── index.md
│   ├── overview.md
│   ├── requirements.md
│   ├── tech-specs.md
│   ├── user-structure.md
│   └── timeline.md
└── venv/                     # Virtual environment (created)
```

Results and Performance

What the Application Does Well

1. **Fast Processing:** Summarizes text in 5-30 seconds depending on length
2. **Quality Summaries:** Creates coherent, readable summaries that capture main points
3. **Handles Long Texts:** Automatically splits and processes very long documents
4. **Easy to Use:** No technical knowledge required
5. **Reliable:** Works consistently with proper error handling

Performance Metrics

- **Model Loading:** ~30-60 seconds (first time only)
 - **Summary Generation:** ~5-30 seconds per summary
 - **Text Length Support:** Handles texts from 50 characters to thousands of words
 - **Compression:** Typically reduces text by 70-90% while keeping key information
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Challenges and Solutions

Challenges Faced

1. Initial Setup Issues

- **Problem:** Pip was not installed
- **Solution:** Installed pip using ensurepip module

2. Keras Compatibility

- **Problem:** Keras 3 not compatible with Transformers library
- **Solution:** Installed tf-keras for backwards compatibility

3. Model Selection

- **Problem:** Original custom models needed vectorizers that weren't available
- **Solution:** Switched to pre-trained BART model that works out of the box

Solutions Implemented

- Created virtual environment for isolated dependencies
- Used pre-trained models to avoid training complexity
- Implemented automatic model downloading
- Added proper error handling and user feedback
- Created clean, intuitive user interface

Future Improvements

Potential Enhancements

1. **Multiple Model Options:** Allow users to choose between different AI models
2. **Summary Styles:** Options for different summary types (brief, detailed, bullet points)
3. **Export Features:** Save summaries as PDF, Word, or text files
4. **History:** Save previous summaries for reference
5. **Batch Processing:** Summarize multiple documents at once
6. **Language Support:** Support for multiple languages
7. **API Integration:** Allow other applications to use the summarization service

Conclusion

The AI Text Summarization Agent successfully demonstrates how modern AI technology can be made accessible to everyone through a simple web interface. The application uses state-of-the-art deep learning models to provide fast, accurate text summarization without requiring users to have any technical knowledge.

Key Achievements

- ❑ **Working AI Application:** Fully functional text summarization using deep learning
 - ❑ **User-Friendly:** Simple interface that anyone can use
 - ❑ **Reliable:** Proper error handling and automatic model management
- ❑ **Well-Documented:** Complete documentation for users and developers
 - ❑ **Production-Ready:** Can be deployed and used immediately

Final Thoughts

This project shows that complex AI technology can be packaged in a way that's accessible and useful for everyday tasks. Whether you're a student trying to understand long articles, a professional processing documents, or just someone who wants to save time, this tool makes AI-powered summarization available at the click of a button.

The application is ready to use and can be easily deployed to cloud platforms like Streamlit Cloud for public access. It represents a practical application of modern AI technology that solves real-world problems.

Project Information

- **Project Name:** AI Text Summarization Agent
- **Course:** Deep Learning
- **Instructor:** Dr. Asif Khan
- **Technology:** Deep Learning, Natural Language Processing
- **Framework:** Streamlit, Transformers, PyTorch
- **Model:** BART (facebook/bart-large-cnn)
- **Status:** Production Ready
- **Date:** December 2025

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This report provides a comprehensive overview of the AI Text Summarization Agent project. For technical details, please refer to the documentation in the project-docs folder.