

UNIVERSITY OF PISA



BUSINESS AND PROJECT
MANAGEMENT

UNIVERSITÀ DI PISA

PLŪMA

Scripta Volant, Digital Manent

NAMAKI - RESPINO - VITTORI

MSC IN ARTIFICIAL INTELLIGENCE AND
DATA ENGINEERING

Overview

INTRODUCTION



CONCLUSION



APPLICATION



ANALYSIS



Introduction



Need of Digitization

In the modern business context, efficiency and **speed in information management** are crucial. Handwritten notes, while useful and often indispensable during meetings, brainstorming sessions, and training sessions,

pose a challenge when it comes to archiving, searching, and sharing. Converting these notes into **digital formats** greatly facilitates these operations, improving accessibility and productivity.

Video Games

Stuffed animals * anything trains
bus pass
face wash

hair spray medicinal
brownies

Melons
innuendos clay
razors

digital credit
foursquare
measuring
cups

cologne

BRAINSTORMINGS

garbage bags

shoe laces

Jelly ^{horns}

bread

- pizza

aspirin

Film boys

cough drops

dog food

ties robes

powertools

software

nail polish

business cards

socks

boots

pipe car

milk

Teal juice barbies

cookie dough wiso

cereal

popcorn

yarn

INK col

milk

plastic sun

playing

scarves

belts

toothpaste

paint fangs

DVD

fruit

oil oil

diapers

bullets

9/1/23

Simpson ← Client Name

In: 2:30

- Motion to suppress ← Hearing Description

Out: 4:17

- Attend

↑

- ME - Client (HS) - Prosecutor (LH)
- Officer Wiggum (cw) - Judge Synder

Time Note

for Billable

Hours

- Direct CW

[Tier 1 Level]

- Background

[Tier 2 Level]

STIP: Training and experience

- Supervisor

[Tier 3 Level]

- Day Shift

- Review reports

- Conduct officer discipline hearings

- Date in question

BUSINESS MEETINGS

- Came in despite being sick

Elasticity : how much demand decrease if price increase

Perfect competition: if you increase price, you lost all demand (infinite elasticity)

Market power: how large increase of price can be afforded w/out losing customers \Rightarrow Apple has a large market power, Fui and competitors compete in minor price differences

GRANDMA'S RECIPES

Victoria sandwich

flour 4 oz

sugar 4 oz

2

4 oz

butter 4 oz
sugar 4 oz
dusting

all together for 20 mins
at 5 or 375°

for 20 mins

Coconut & cherry cake

Plain flour 8 oz

Salt 1/4 level teaspoonful

Baking powder 1 1/2 level teaspoonsfuls

Margarine 3 oz

Glacé cherries 1 oz

Granulated sugar 3 oz

Grated coconut 2 oz

Eggs 1

Milk 1/4 pint.

Cooking oil

greaseproof paper.

Topping

Evaporated milk 2 tablespoons

Castor sugar 1/2 oz

Grated coconut 1/2 oz

Glacé cherries 3.

1/16 flour

1/16 butter

1/2 oz finely-chopped lemon

4 lb Demerara sugar

1/4 oz ground ginger

treacle

Sieve flour

Add sugar and rub in butter

ring.

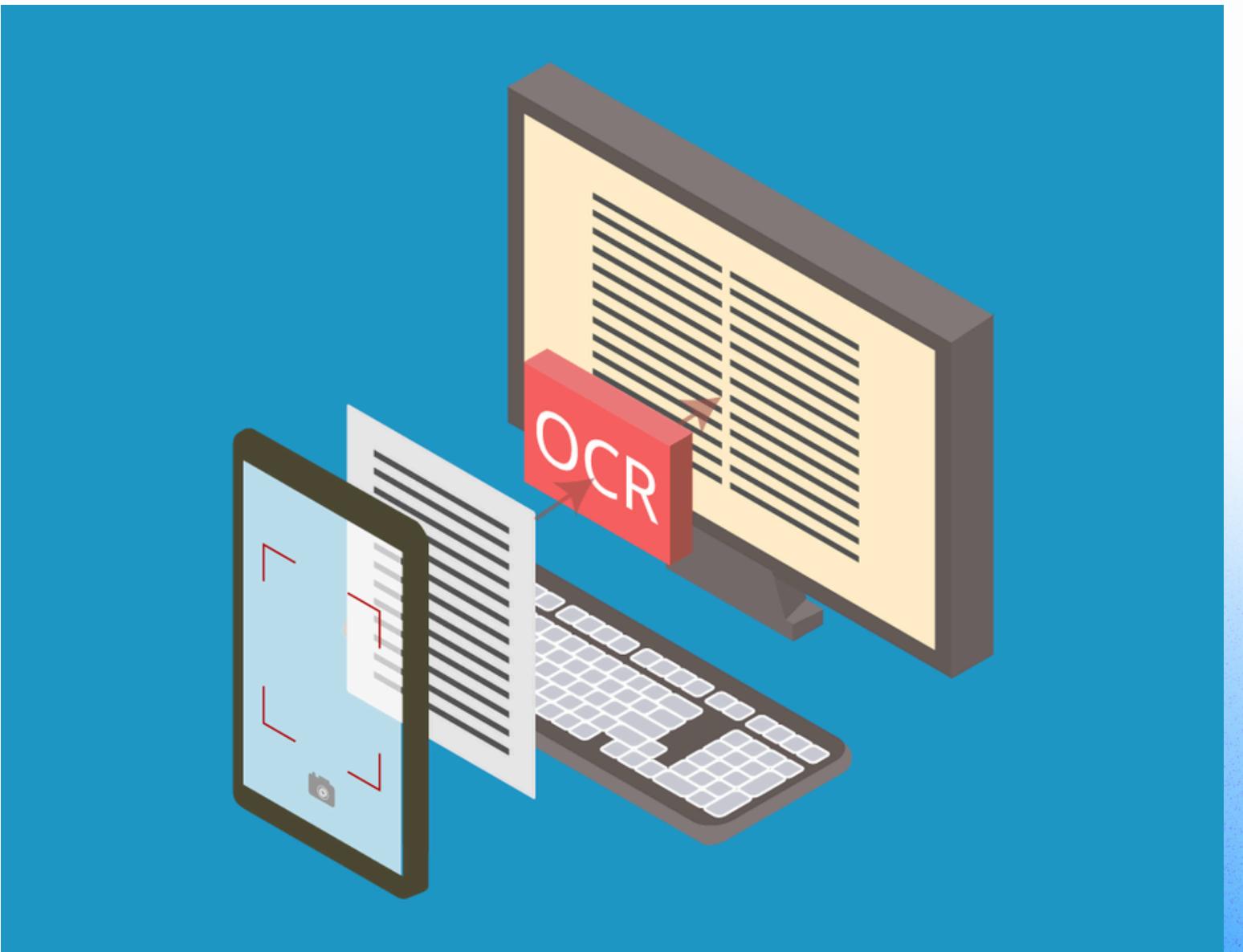
Melt the t

ginger and butter

lemon

Problem

Traditional OCR models are optimized for printed and structured text but struggle with the variability and **complexity of handwriting**. In this context, the model used in this application offers an innovative and specialized approach to address these challenges.



Objectives

📌 STRUCTURED DIGITALIZATION



Text conversion in **structured digital formats** such as Plain Text, LaTeX (widely used for **academic** purposes) and Markdown (widely used by **programmers**).

📌 NOTE ENHANCEMENT



Enhance digital notes by leveraging AI to search the web for **relevant information** on the topic, correct **semantic errors**, and **expand on superficially transcribed concepts**.

Application

APPLICATION

Plūma

Choose a PDF of handwritten notes

Drag and drop file here
Limit 200MB per file • PDF

Browse files

Appuntii.pdf 15.2MB X

Convert to Plain Text Convert to Markdown Convert to LaTeX

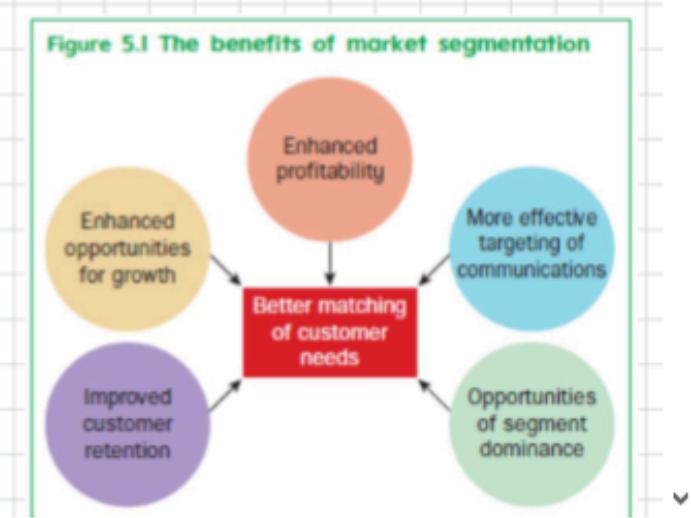
Uploaded PDF with 4 pages

Segmentation, Targeting, Positioning

Segmentation: Identification of individuals or organizations with similar characteristics that have significant implications for the determination of marketing strategy (eg. adult/children movies production). Of course maybe segmentation can be a bad idea (eg. CocaCola cannot have it). Segmentation can be also based on geography... It's a commercially viable method to satisfy different customer needs and it's the heart of market strategy. Benefits of segmentations are many:

1. Customer retention: It's based on customer's loyalty. It's a phenomenon that it's discovered in the future: with segmentation it's more present.
2. Enhanced profitability: More the clients are satisfied, more they're prepared to pay for the product, allowing to raise company's profits.

Figure 5.1 The benefits of market segmentation



Conversion Result

Converted file

Marketing

Module

- Understand the role of marketing in business
- Identify the different types of marketing
- Explain the marketing process
- Develop a marketing plan

Segmentation Targeting Positioning

****Segmentation****

Segmentation is the identification of numerous customer characteristics that have relevant implications for the determination of marketing strategy (eg. adult/children, movies production).

Of course, maybe segmentation can be a bad idea (eg. Coca-Cola cannot have it).

Segmentations can be also based on geography - this method to satisfy different customer needs it's the heart of "warlike" strategy. But its' segmentations are wary.

[Enhance Text](#)

[Save changes](#)

APPLICATION

Enhance Text

Text to enhance

Another fundamental distinction is between **B2C** and **B2B**.

B2C cultures of consumers require a good authority to state that a good is valuable. For example, companies are often unable to sell products directly to consumers.

B2B buyers tend to be directly contacted.

Save changes

Enhanced text

B2B marketing strategies are designed to reach and engage businesses. There are a number of different B2B marketing strategies that can be used, including:

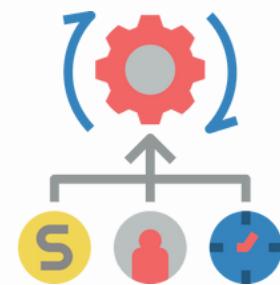
- * **Content marketing**
- * **Search engine optimization (SEO)**
- * **Social media marketing**
- * **Email marketing**
- * **Direct mail**
- * **Trade shows**
- * **Public relations**

The best B2B marketing strategy for a particular business will depend on a number of factors, including the target market, the budget, and the company's goals.

B2C Marketing Strategies

B2C marketing strategies are designed to reach and engage consumers. There are a number

Application Limits



RESOURCE USAGE

The maximum file size that can be uploaded is **200MB**. This limit is predefined by Streamlit library on which the developed interface is based.



TRANSCRIPTION LIMITS

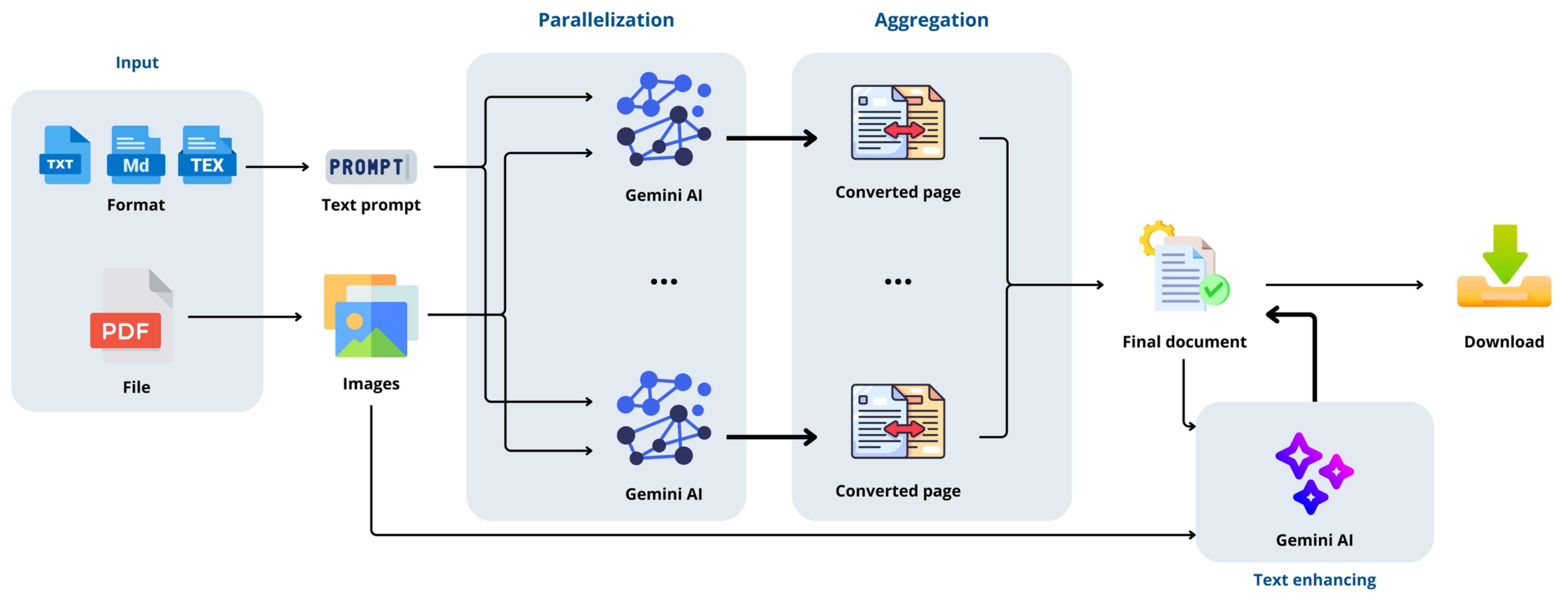
Gemini has a maximum response limit of **8,192 tokens**. Given an average of 0.75 words per token in English and an average of 4 characters per token, each response can handle approximately **6,144 words** or 32,768 characters.



IMAGES AND TABLES

The model used by the application can **extract text** from images, tables, and charts, attempting to recreate the original formatting as closely as possible, accordingly to the required file format.

Workflow



Gemini API

01

Designed to convert handwritten notes into digital format with **high accuracy** and efficiency

03

Utilizes a **Recurrent Neural Network** to analyze this sequential nature. RNNs are adept at understanding the relationships between characters, allowing Gemini to decipher the flow of your writing

02

Similar to how we recognize shapes in images, Gemini **identify patterns** and strokes within your handwritten notes

04

Once extracts features and analyzes their order, Gemini employs a technique called **Connectionist Temporal Classification** to convert the processed information into actual text

Analysis and Comparison

Conversions Results

ANALYSIS AND COMPARISON

MathPix

UAR|<ETING

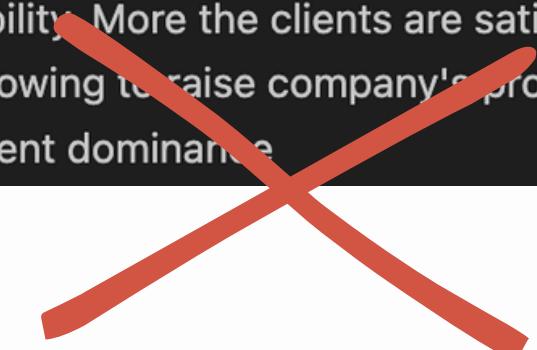
Segmentation, Targeting, Positioning

Segmentation: Identification of individuals or organizations with similar characteristics that have significant implications for the determination of marketing strategy (eg. adult / children movies production).

Of course maybe segmentation can be a bad idea (eg. Coca-Cola cannot have it).

Segmentation can also be based on geography. Has a commercial value to satisfy different customer needs and it's the way of war let strategy. Benefits of segmentations are many:

1. Customer retention: It's based on customer's loyalty. It's a phenomenon that it's discovered in the future: with segmentation it's more present.
2. Enhanced profitability: More clients are satisfied, more they're prepared to pay for the product, allowing to raise company's profits.
3. Opportunity of regional dominance.



Plūma

Marketing

Module

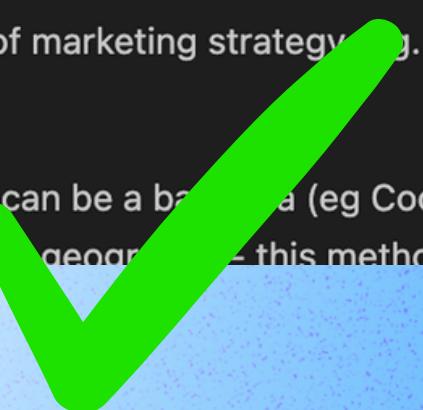
- Understand the marketing mix
- Analyze the marketing environment
- Develop marketing strategies
- Create effective marketing campaigns
- Evaluate marketing results

Segmentation Targeting Positioning

Segmentation

Segmentation is the identification of numerous characteristics that have relevant implications for the determination of marketing strategy (eg. adult/children movies production).

Of course, whatever segmentation can be a bad idea (eg. Coca-Cola cannot have it). Segmentations can be also based on geography - this method to satisfy different customer



Comparison Table

ANALYSIS AND COMPARISON

FEATURE	PLŪMA APPLICATION	GENERIC TRANSCRIPTION APPLICATION
MODEL	DEEP-LEARNING MULTI-MODAL NEURAL NETWORK	OCR NEURAL NETWORK
CHARACTERS RECOGNITION	✓	✓
CONTENT FORMATTING	✓	✓
CONTEXT RECOGNITION	✓	✗
GRAMMATICAL ERROR CORRECTION	✓	✗
CONTENT ENHANCEMENT	✓	✗
HANDWRITING FLEXIBILITY	✓	✗

Performance Metrics



COSINE SIMILARITY

The results indicated that our model achieved an **accuracy of 84%**, whereas the OCR model achieved 56%.



JACCARD INDEX

Our model achieved a Jaccard similarity score of **accuracy of 42%**, indicating a stronger resemblance to the original text compared to the OCR model, which scored **accuracy of 21%**.

Conclusion

Results

ACCURACY OF WORDS

The results obtained from the first test, which aimed to analyze the accuracy of words within the text, show a **significant increase in the accuracy** of the application's model compared to traditional OCR models. This is likely due to the model's superior ability and **flexibility** to adapt to different writing styles within the same text, as well as the processing of the detected text based on the **context-provided semantics**, allowing for the correction of errors during the text detection phase

Future developments

- 📌 REAL-TIME PROCESSING
- 📌 ADDITIONAL FORMATS
- 📌 USER INTERFACE IMPROVEMENTS
- 📌 CLOUD INTEGRATION
- 📌 CUSTOMIZATION OPTIONS
- 📌 INTEGRATION WITH OTHER TOOLS

Conclusion

Plūma represents a **significant advancement** in the field of handwriting recognition and note digitization. With its specialized AI model, advanced preprocessing techniques, and innovative features like **AI-powered note enhancement**, it offers a comprehensive solution for converting handwritten notes into valuable **digital assets**. Whether for businesses, educational institutions, or professionals, Plūma is poised to revolutionize the way handwritten notes are managed and utilized.

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THANK YOU