

**BABEȘ-BOLYAI UNIVERSITY CLUJ-NAPOCA**  
**FACULTY OF MATHEMATICS AND COMPUTER SCIENCE**  
**SPECIALIZATION IN COMPUTER SCIENCE**

# **Painting recognition on mobile devices using computer vision algorithms**

**Supervisor,**  
**Lect. Dr. Bufnea Darius**

**Author,**  
**Neșă Rareș**



# Contents

1. Introduction
2. Related work
3. Theoretical background
4. Used technologies
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**WHAT  
ARTIST ?**

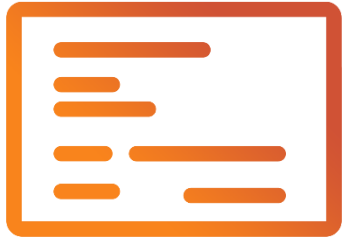
**WHEN?**

**ART**

**WHY?**

**WHAT IS THE  
STORY ?**

**Side panel  
information**



**Search  
engines**



**Audio  
guides**



**Guided  
tours**



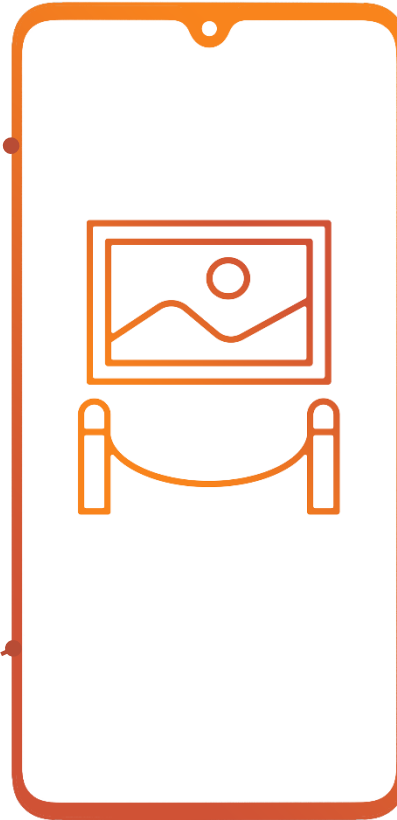
**Not always available or efficient...**

**Open access to  
knowledge**

**Community driven /  
always updating  
data**

**Reaching a wide  
segment of  
population**

**Good user  
experience**



# HOW ?

1. Get a picture from gallery or camera
2. Find the paintings coordinates from the frame
3. Crop it based on the coordinates
4. Match it from a given database of paintings

# Related work

## Object detection

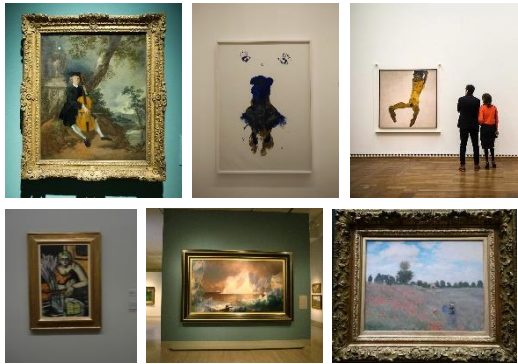
- **Contour-based** object detection
- **Neural networks** for object detection

## Finding visually similar images

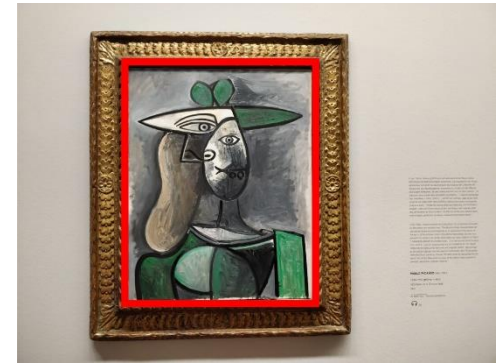
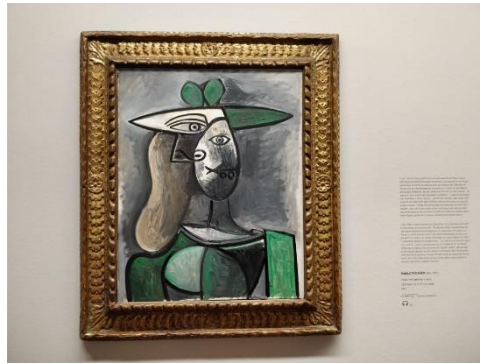
- **Histogram** comparison
- Detail preservation **hashing**
- **Keypoint oriented** matching



# Detecting the painting coordinates using an SSD



TRAINING



DETECTION



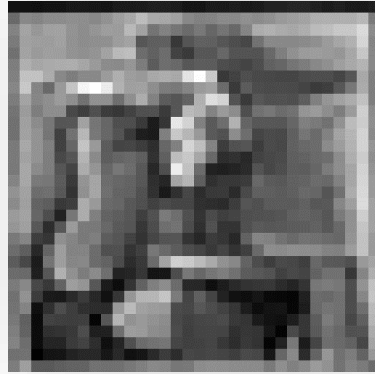
[x: 0.2265,  
y: 0.1770,  
h: 0.6484,  
w: 0.4794]



# Narrowing the search using perceptual hashing



**RESIZE**  
**CONVERT TO B&W**

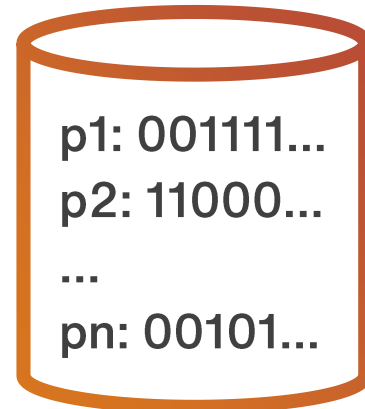


**DCT**  
**REDUCE**



[ p1, p13,  
p101, p102,  
..., pk ]

**SELECT TOP**  
**MATCHES**



**COMPARE**  
**DISTANCE**

00000000  
00001110  
00100100  
....

# Matching the image using ORB



**COMPUTE  
KEYPOINTS**



**DESCRIBE  
KEYPOINTS**

[00101001...,  
10101001...,  
10100000...,  
...]



pb

**SELECT  
BEST MATCH**

[ p1, p13,  
p101, p102,  
..., pk ]

**COMPARE #  
OF MATCHES**

# Used technologies



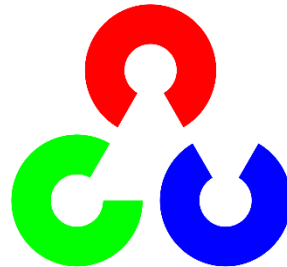
**FLUTTER**



**ANDROID**



**TENSORFLOW**



**OPENCV**



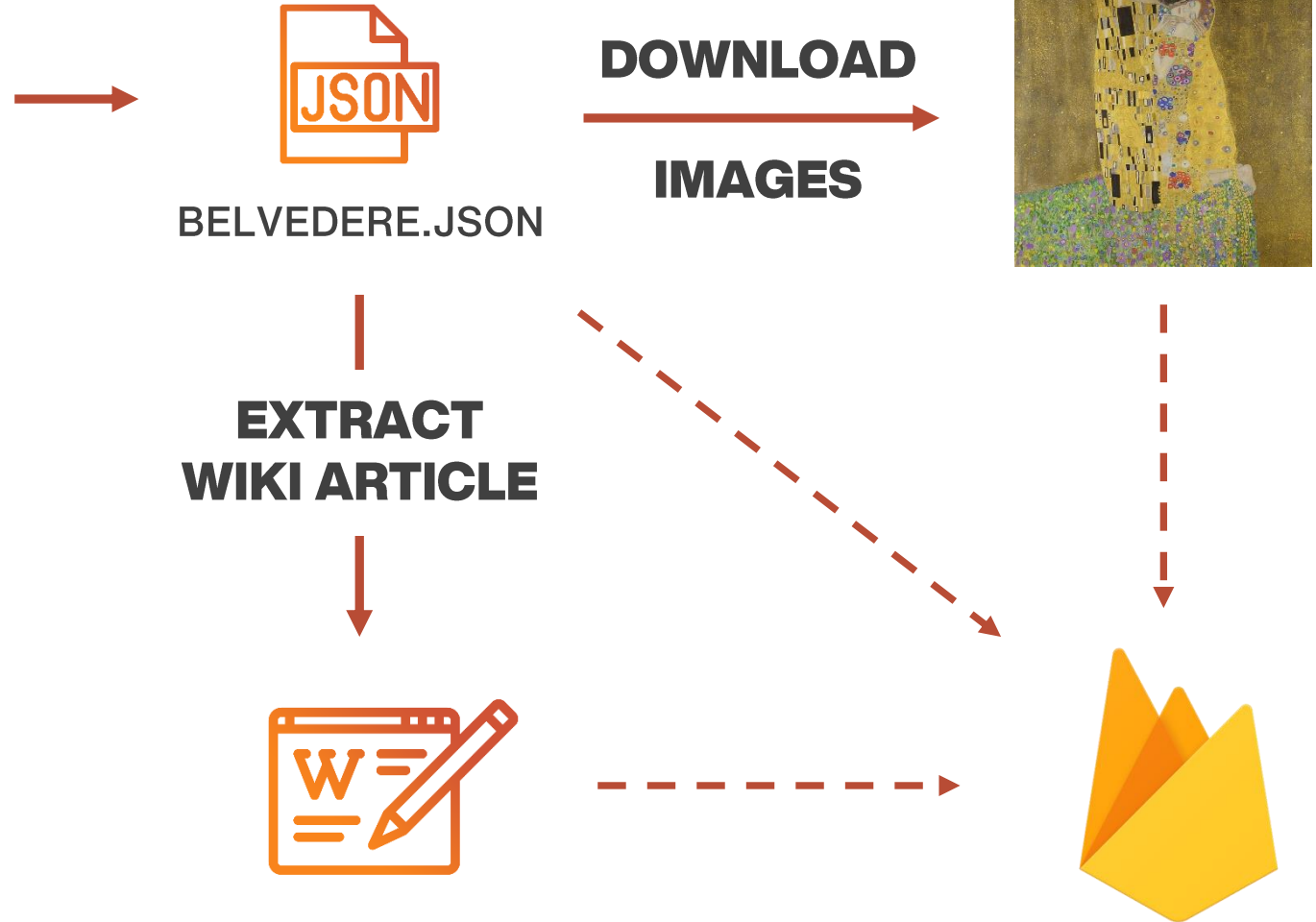
**WIKIDATA**



**FIREBASE**

# Populating the database

```
1 #defaultView:ImageGrid
2 PREFIX schema: <http://schema.org/>
3
4 SELECT DISTINCT
5   ?item (GROUP_CONCAT(DISTINCT ?itemLabel; separator=", ") as ?itemLabel)
6   ?image (GROUP_CONCAT(DISTINCT ?collection; separator=", ") as ?collection)
7   (GROUP_CONCAT(DISTINCT ?creatorLabel; separator=", ") as ?creatorLabel)
8   (GROUP_CONCAT(DISTINCT ?inception; separator=", ") as ?inception)
9   (GROUP_CONCAT(DISTINCT ?height; separator=", ") as ?height)
10  (GROUP_CONCAT(DISTINCT ?width; separator=", ") as ?width)
11  (GROUP_CONCAT(DISTINCT ?copyrightLabel; separator=", ") as ?copyrightLabel) ?article
12  (GROUP_CONCAT(DISTINCT ?mediumLabel; separator=", ") as ?mediums)
13 WHERE {
14   ?item wdt:P195/wdt:P361* ?collection ; # That are in some collection
15         wdt:P18 ?image ; # that have images
16         wdt:P170 ?creator .
17
18   {?item wdt:P31 wd:Q3305213 . } # Get items that are instances of painting
19   UNION
20   {?item wdt:P31 wd:Q93184 . } # Get items that are instances of drawing
21
22   OPTIONAL { ?item wdt:P571 ?inception ; wdt:P186 ?medium ;
23               wdt:P2048 ?height ; wdt:P2049 ?width . }
24   OPTIONAL { ?item wdt:P6216 ?copyright . }
25   OPTIONAL { ?article schema:about ?item . ?article schema:inLanguage "en" .
26             ?article schema:isPartOf <https://en.wikipedia.org/> . }
27
28   # Only return results where 'collection' is Belvedere
29   FILTER ( ?collection = wd:Q303139 )
30
31   SERVICE wikibase:label {
32     bd:serviceParam wikibase:language "en". ?item rdfs:label ?itemLabel .
33     ?creator rdfs:label ?creatorLabel . ?copyright rdfs:label ?copyrightLabel .
34     ?medium rdfs:label ?mediumLabel . }
35 }
36 GROUP BY ?item ?itemLabel ?image ?article
```



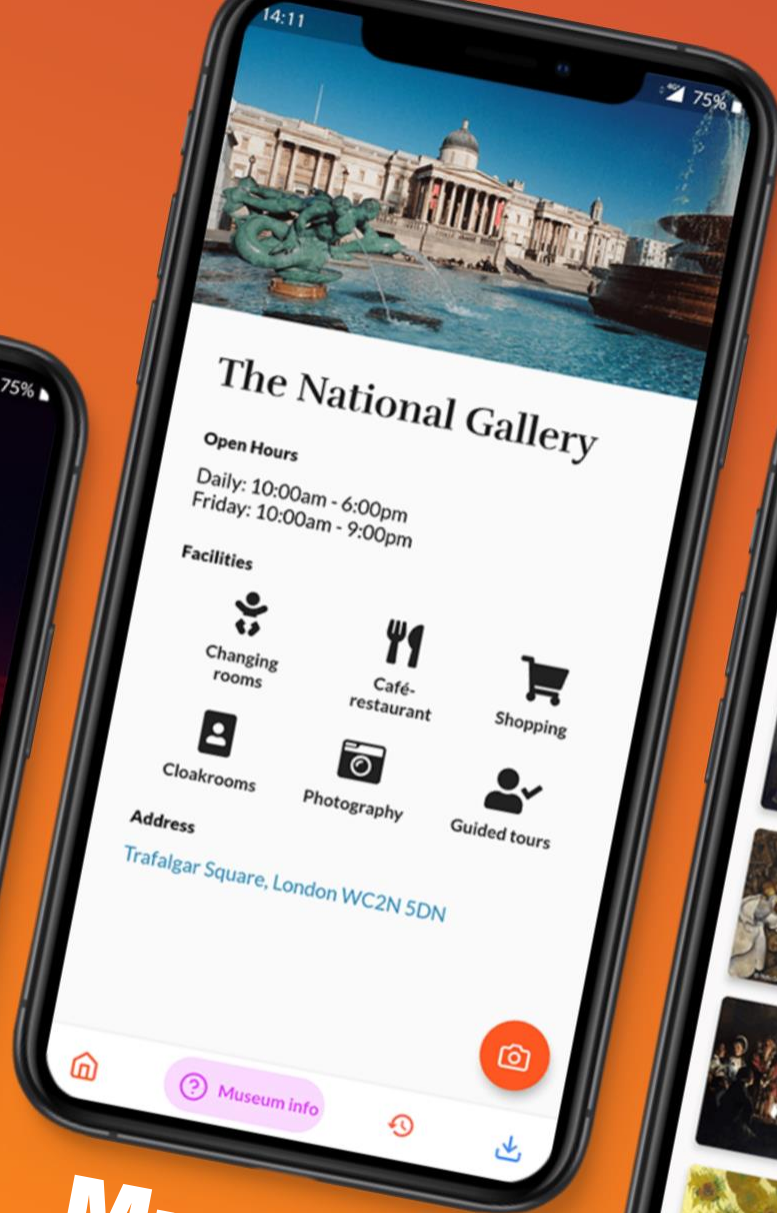


# DETECTION USER INTERFACE



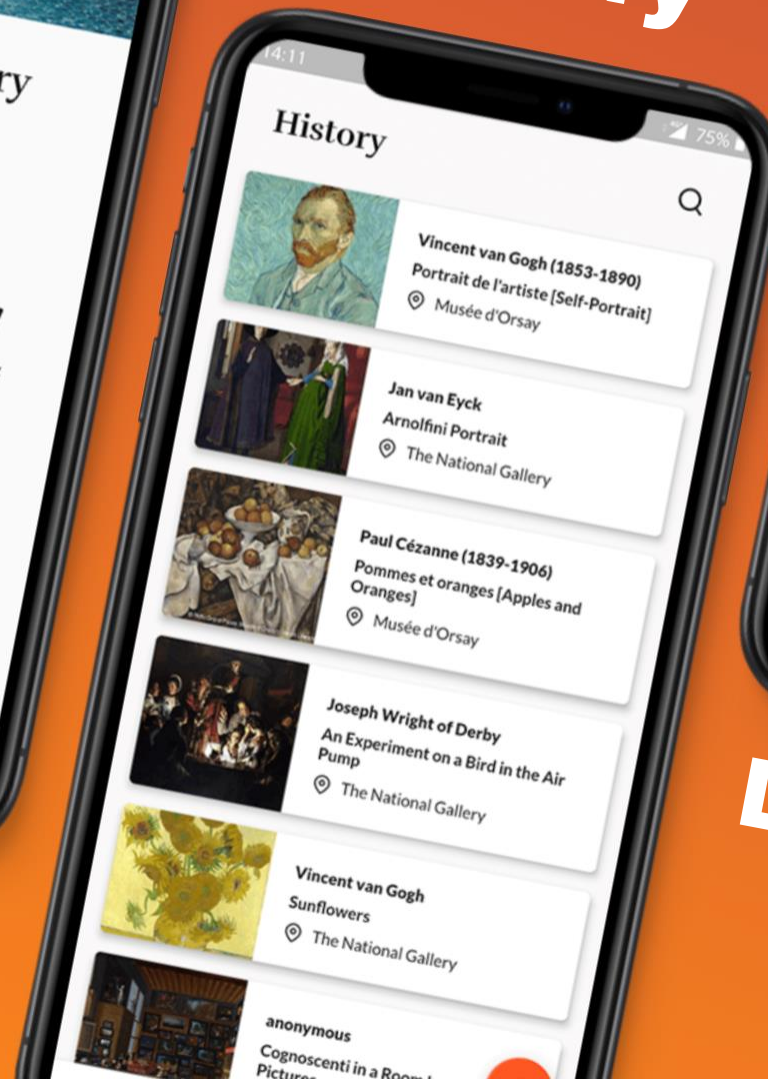


# Home



# Museum info

# History



# Downloads



## Material design



**Pablo Picasso**

Frau mit grünem Hut - Woman in a Green Hat

1947

In 1935, Pablo Picasso met Dora Maar, a young photographer among the Surrealists. Picasso had ...

## Animations



Home

## Text-to- speech



## Search



Alber|





# Conclusion

- **Real-time detection  
(between 500ms – 2s)**
- **Reliable in most common  
situations**
- **Available on most android  
devices requiring version 5+  
(88,4%)**

# Further improvements

- **Detect other forms of art  
(statues, artefacts, etc.)**
- **Detect over the internet  
without downloading  
additional data**
- **Create a platform for user  
contributions**

