Evaluation of Algorithms for the Summarization of Photo Collections

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Overview

1. Introduction
2. System Overview
3. Evaluation
4. Conclusion

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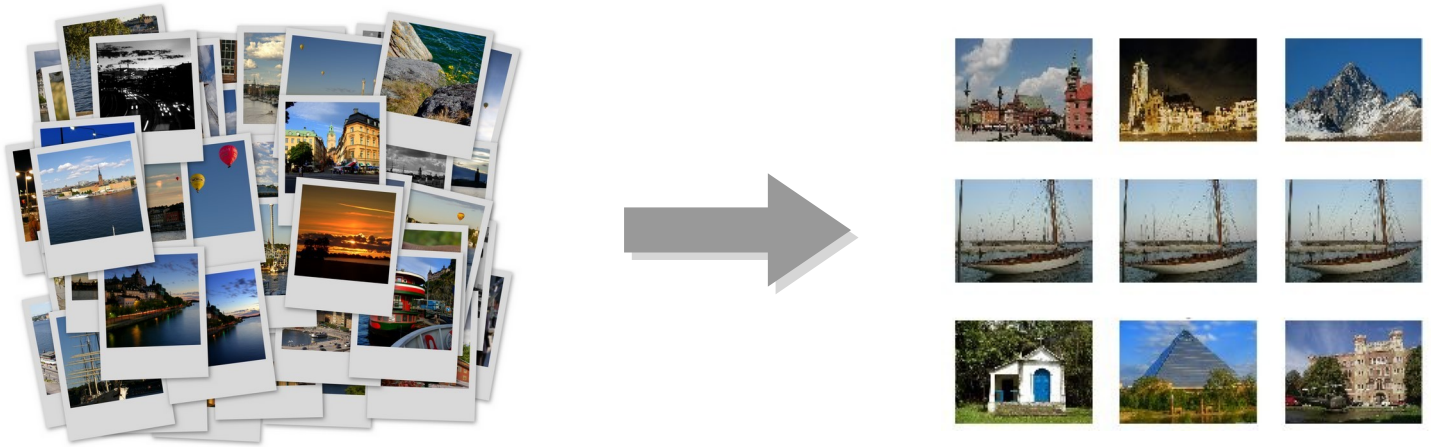
1. Introduction

- increasing size of personal photo collections (digitalization)
- photographers built “photo summaries“
- system supports the user by automatically building a subset



- creation of a photo summary is always a very subjective task
  → evaluation is difficult

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2. System Overview

- criteria upon which a human user would rate digital photos
  - image appeal – Is it a succesful photography?
  - image importance – Does the image show an important subject/event?
  - presence of people – Does the photo show people, friends or family?
  - redundancy – Are there similar photos showing the same subject?
  - visual variety – Does the summary contain visual diversified images?
  - representativity – Are all stages and aspects of the underlying event present in the photo collection?

- all these aspects are considered within our system

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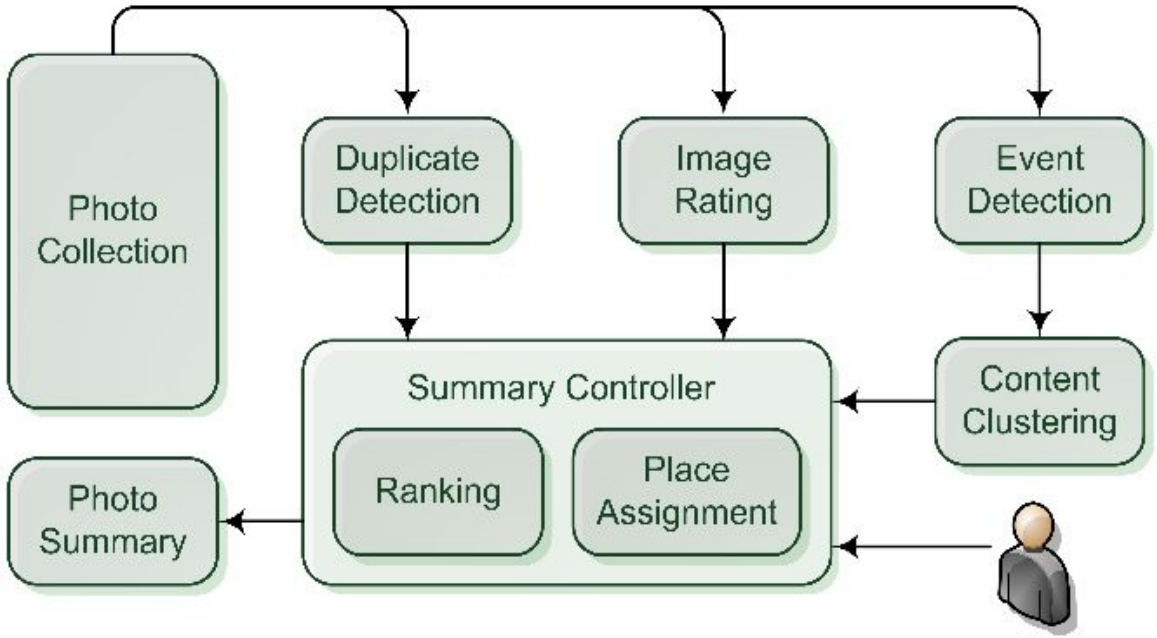

- Duplicate Detection:
  - detection of near-identical images using MPEG-7 color layout descriptor
  - detection of images showing the same subject using the SIFT algorithm

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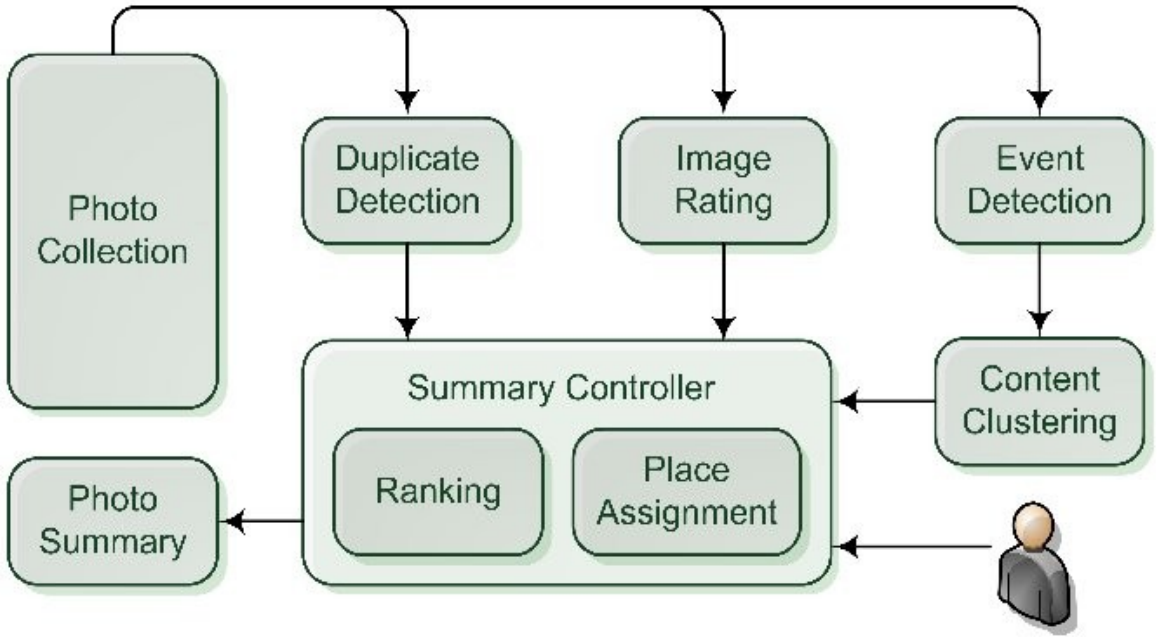

- Image Rating:
  - people score: combination of skin and face detection
  - image importance score: high photografic rate → important event
    many duplicates → important subject
  - image appeal score: several visual features to distinguish between low and high image appeal using a SVM classifier

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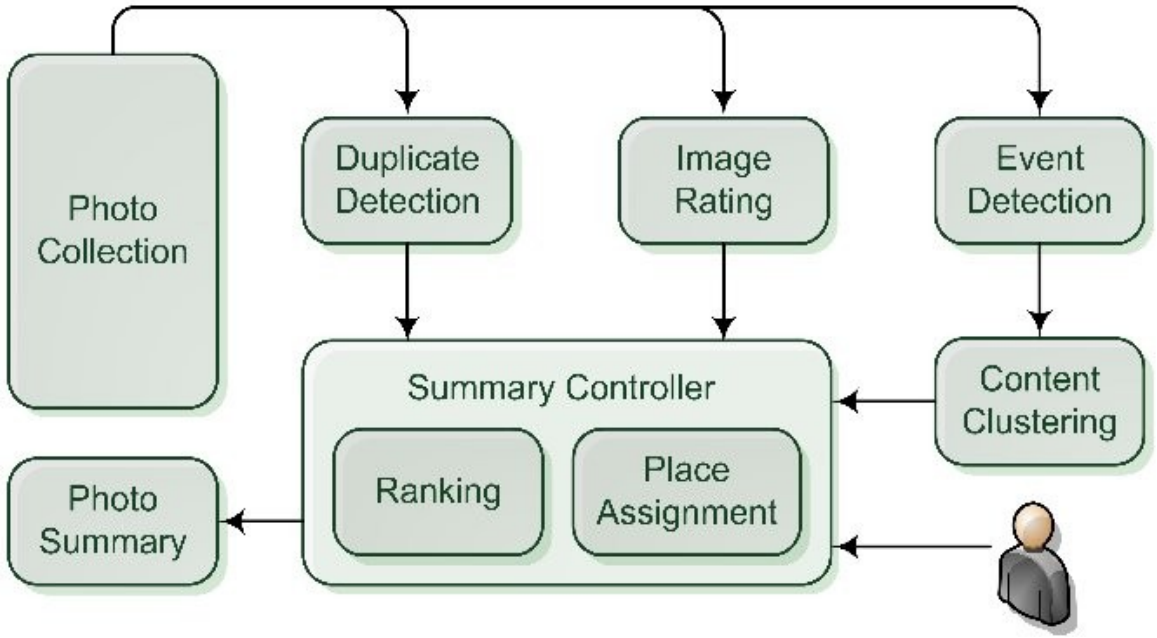

- Event Detection
  - every event should be present in the summary
  - calculation of time gaps between consecutive images
  - clustering in two groups: „large gaps“ vs. „small gaps“
  - Images with large gaps are considered to be event boundaries

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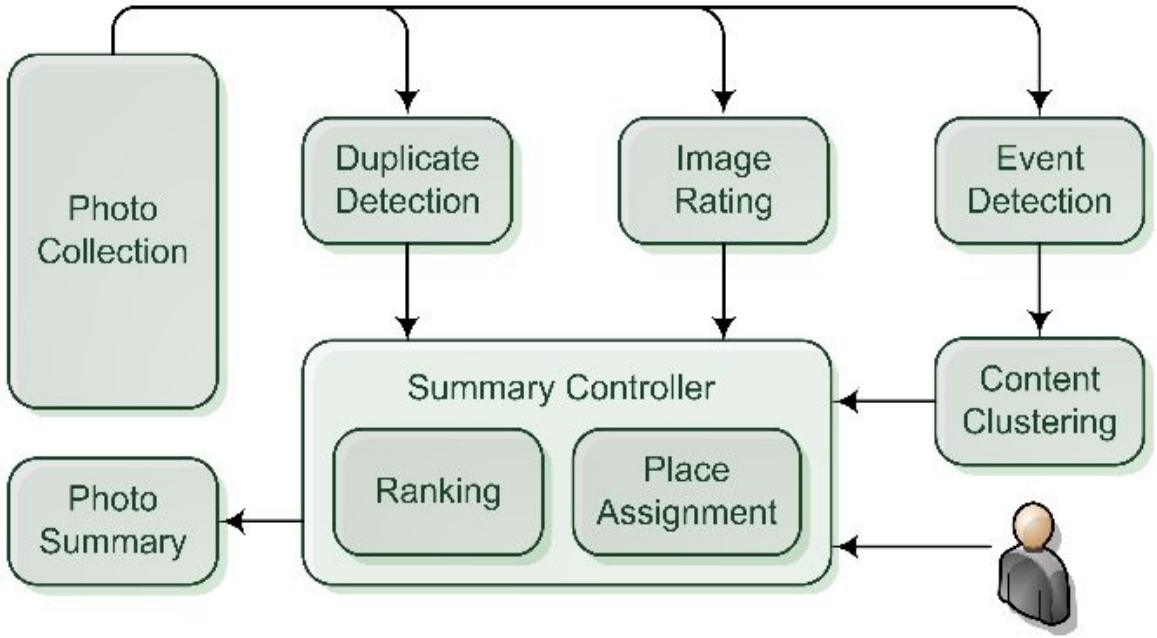

- Content Clustering
  - every visual aspect of each event should be in the summary
  - clustering of images in each event by content
  - using HSV color histograms and g-means clustering algorithm

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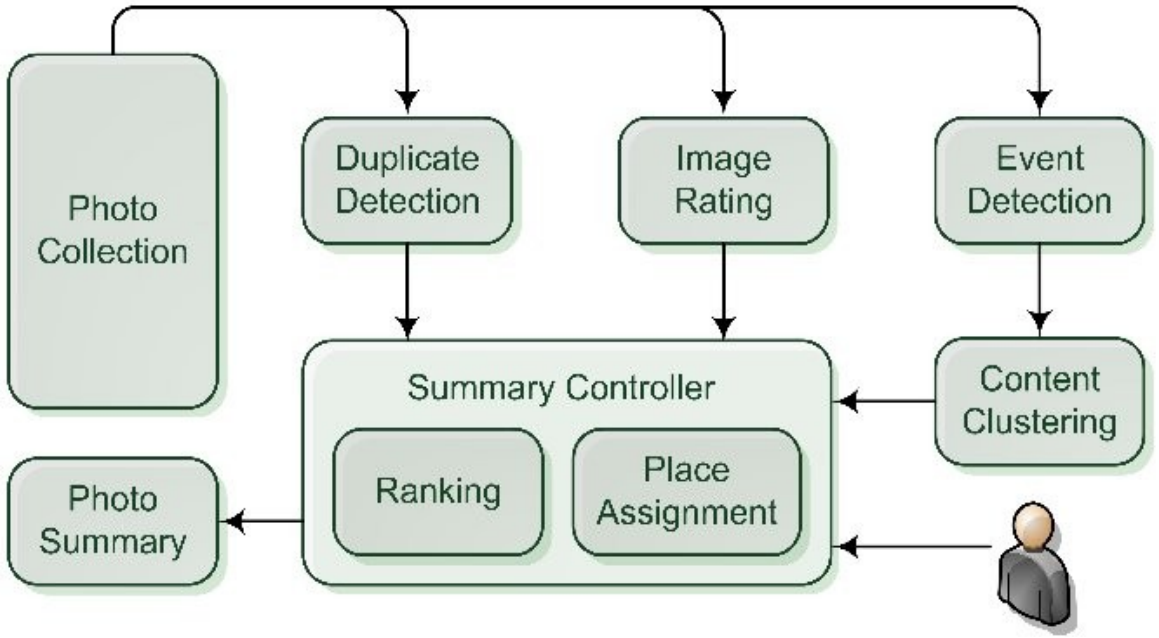

- Controller
  - calculation of a combined score for every image for every event and every content cluster separately
  - user selects the size of the final photo summary (Place Assignment)
  - user targets the weighting of each score (Ranking)

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3. Evaluation

1. testpersons provide private photo collections
   every algorithm produces a photo summary for every collection
   each testperson evaluates the summary for his/her own collection

   → enormous human effort

   → not applicable for non-profit evaluation initiative such as ImageClef

2. testpersons provide private photo collections
   every algorithm produces a photo summary for every collection
   participants act as assessors

   → prevent human effort by including the participants itself

   → already performed on previous challenges (e.g. MIREX for Music Similarity)

3. testpersons create a ground truth for one photo collection
   all algorithms generate a summary for this collection
   tested against the ground truth data

   → results of the algorithms could be compared and evaluated immediately

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Procedure:

- set of 500 pictures
- 20 testpersons create their own photo summary
- should include 100 images (20%)
- assign points to every chosen image
  → number of people who had chosen the specific picture
- final score of the system is the sum of all points of the automatically chosen images

$$P = \sum_{i=1}^{N} p_i,$$

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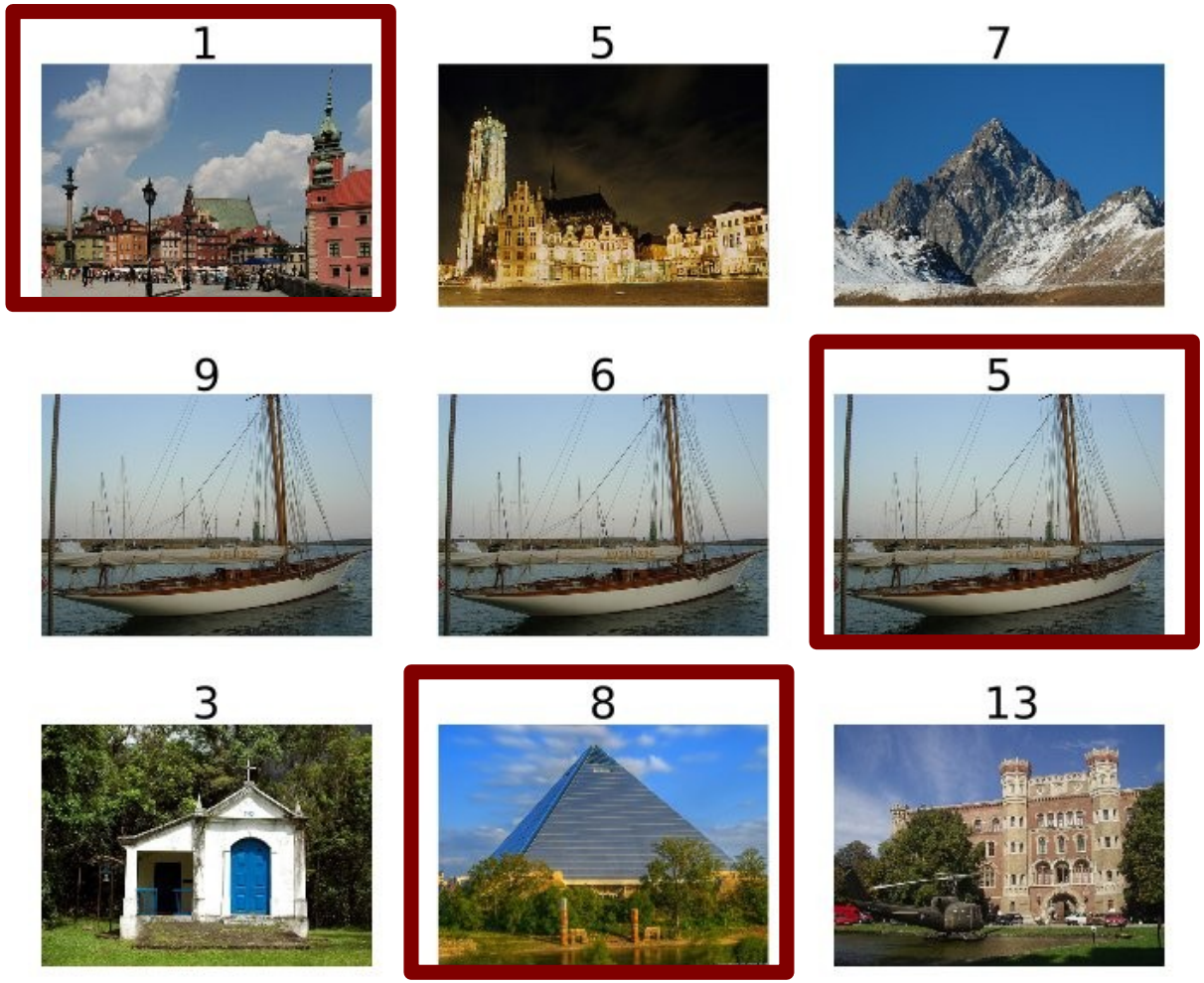
Disadvantages:



System 1:

1 + 5 + 8 = 13 Points

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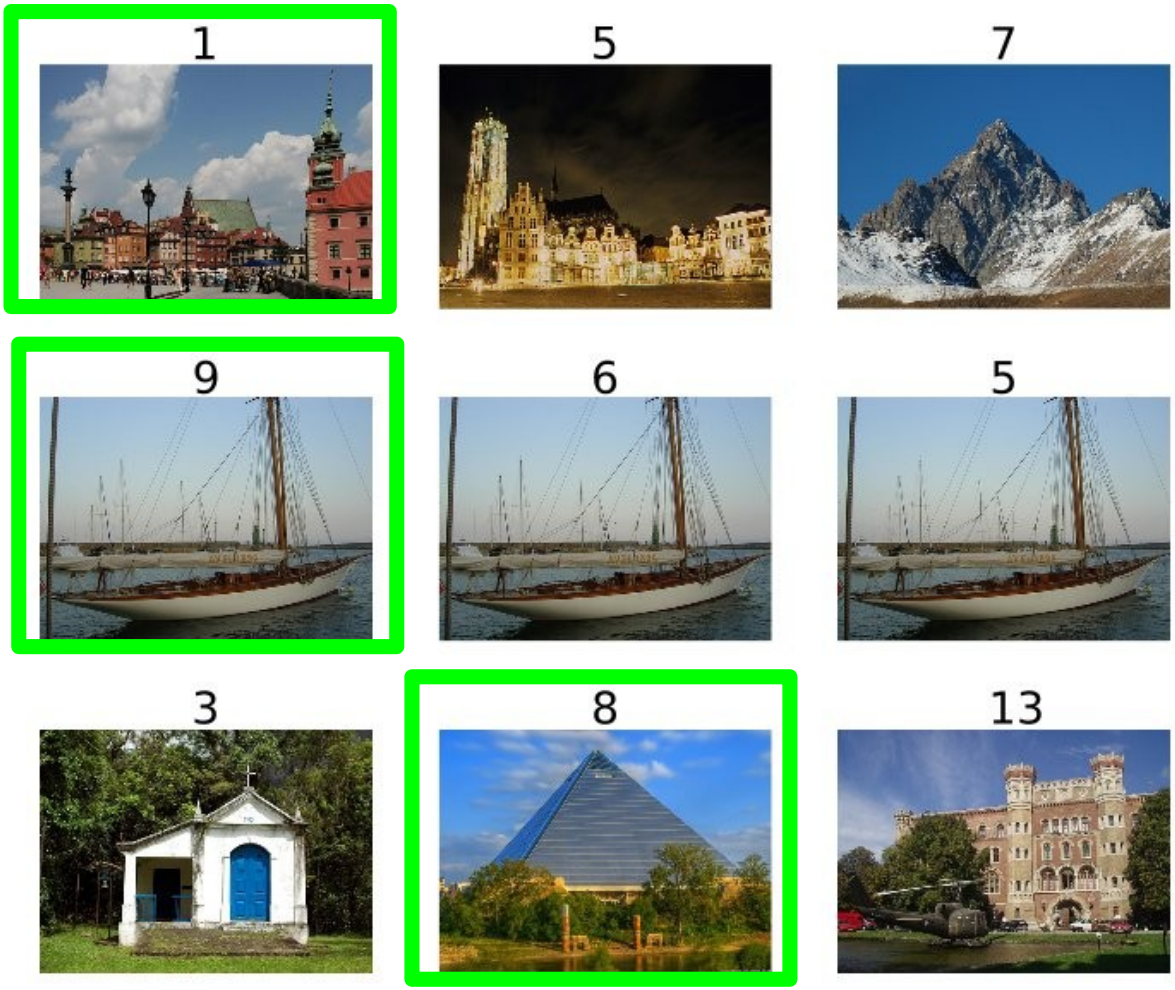
Disadvantages:



System 1:
1 + 5 + 8 = 13 Points

System 2:
1 + 9 + 8 = 18 Points

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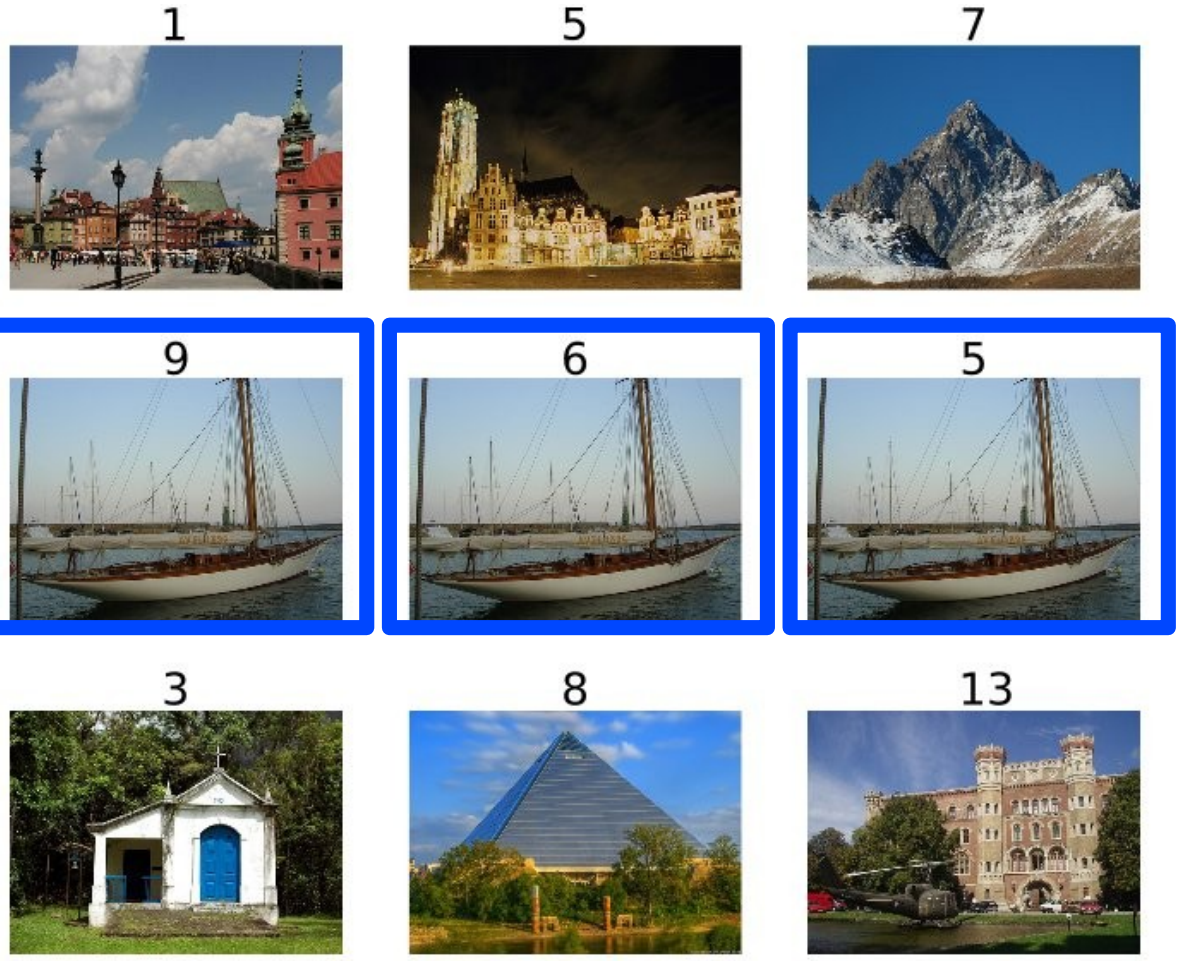
Disadvantages:



System 1:
1 + 5 + 8 = 13 Points

System 2:
1 + 9 + 8 = 18 Points

System 3:
9 + 6 + 5 = 20 Points

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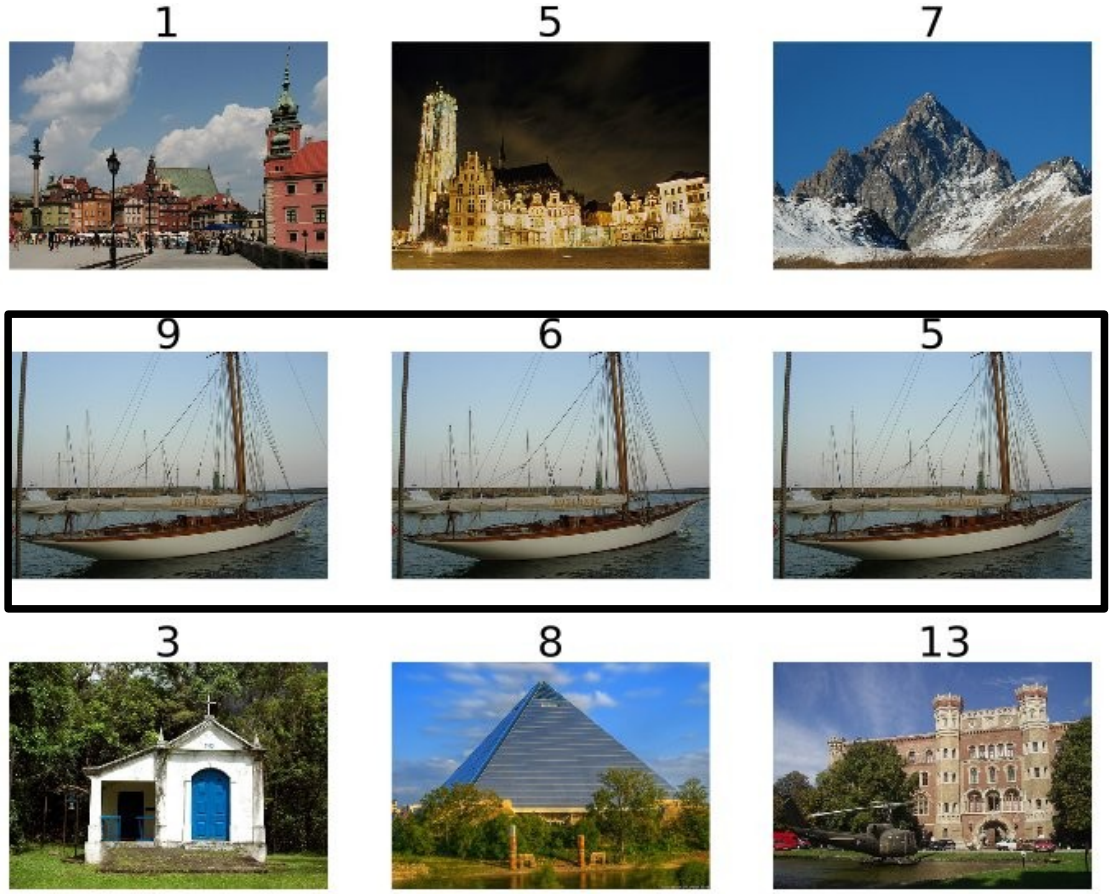
Solution:

- manually label duplicates in collection
- provide same score for duplicates by summing up single scores
- doesn't matter wich duplicate is chosen by the system



9 + 6 + 5 = 20

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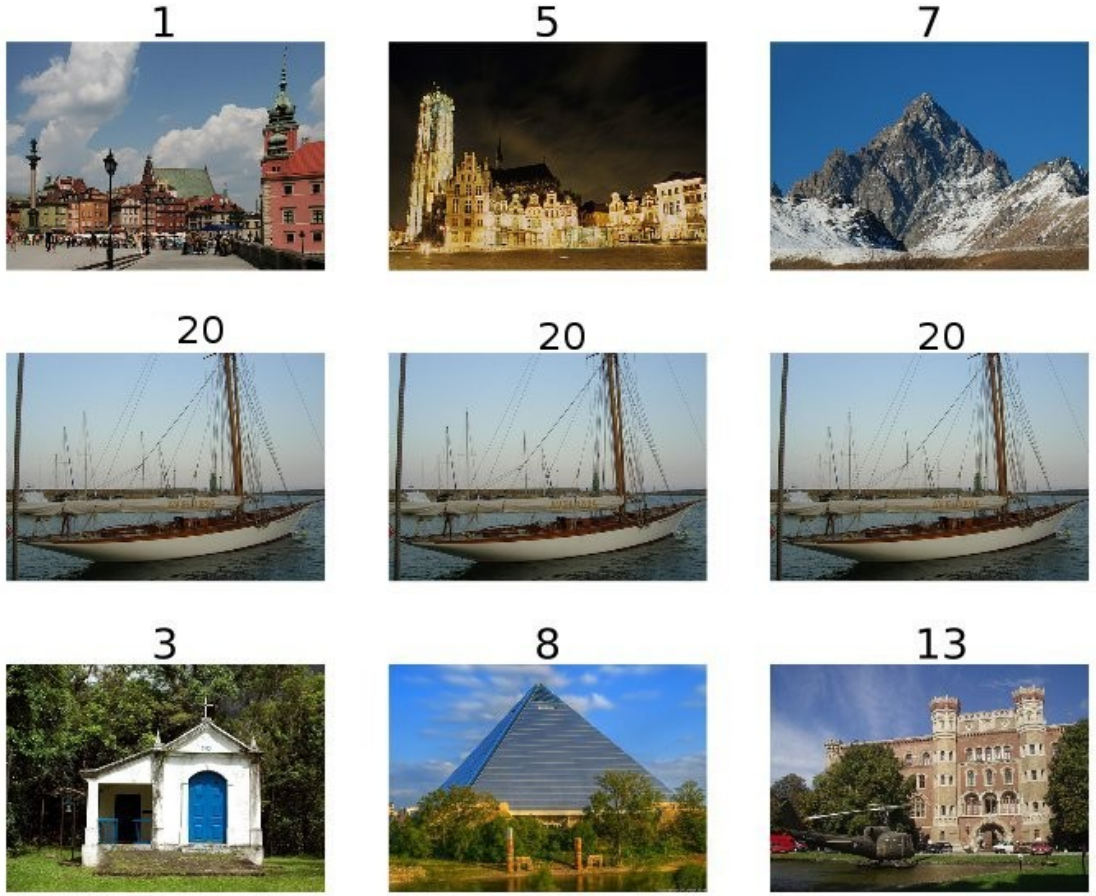

9 + 6 + 5 = 20

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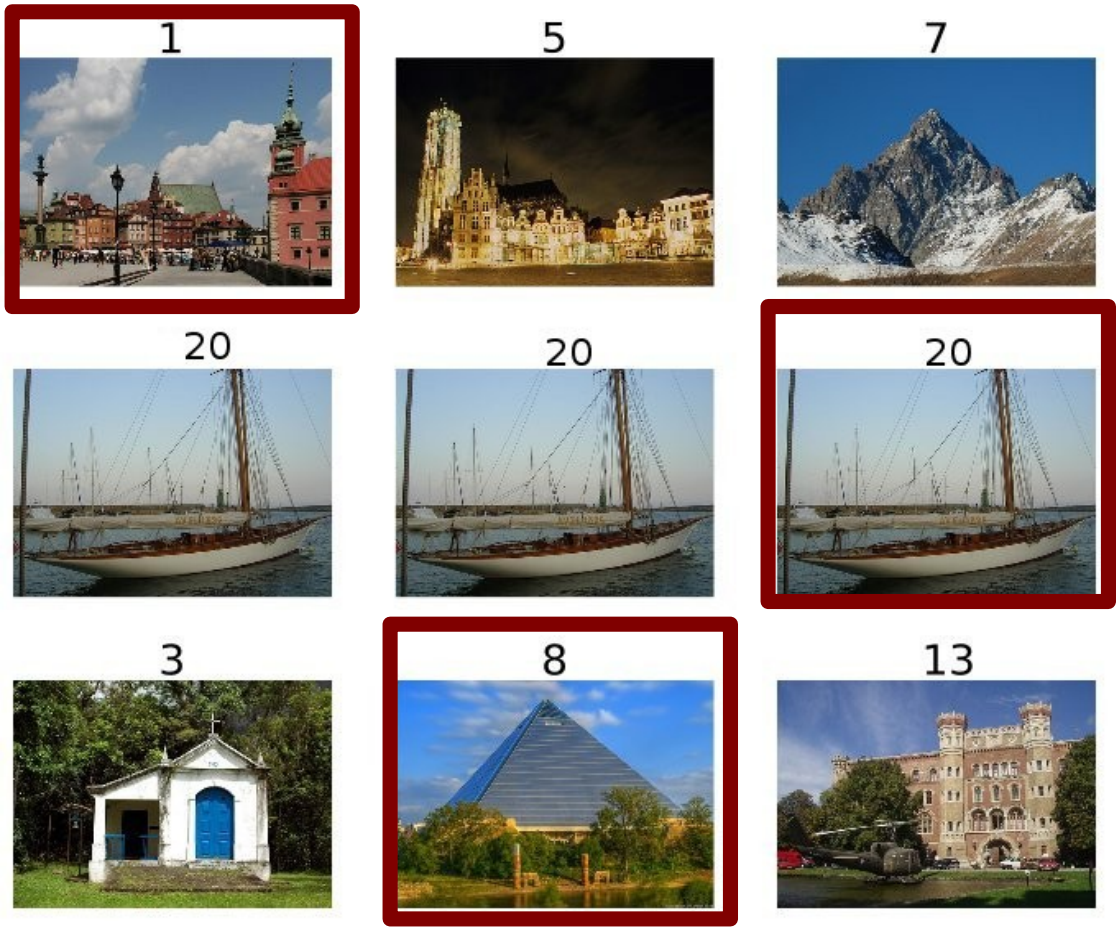
- fine the system that takes more than one duplicate image
- subtract weighted score for duplicate images



System 1:

1 + 20 + 8 = 29 Points

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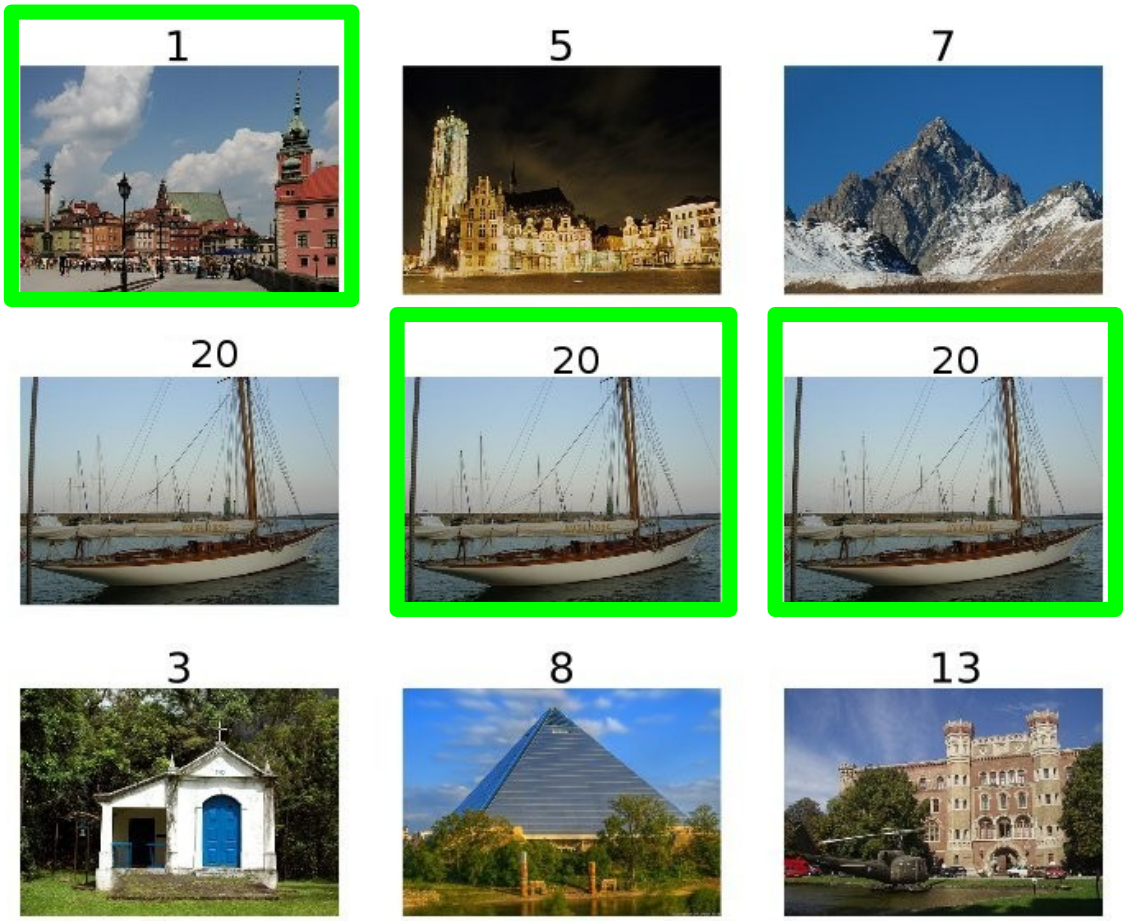
- fine the system that takes more than one duplicate image
- subtract weighted score for duplicate images



System 1:

1 + 20 + 8 = 29 Points

System 2:

1 + 20 - 1*1/3*20 = 7.6 Points

Number of duplicate images chosen by the system -1

1/(Number of duplicate images in the photo collection)

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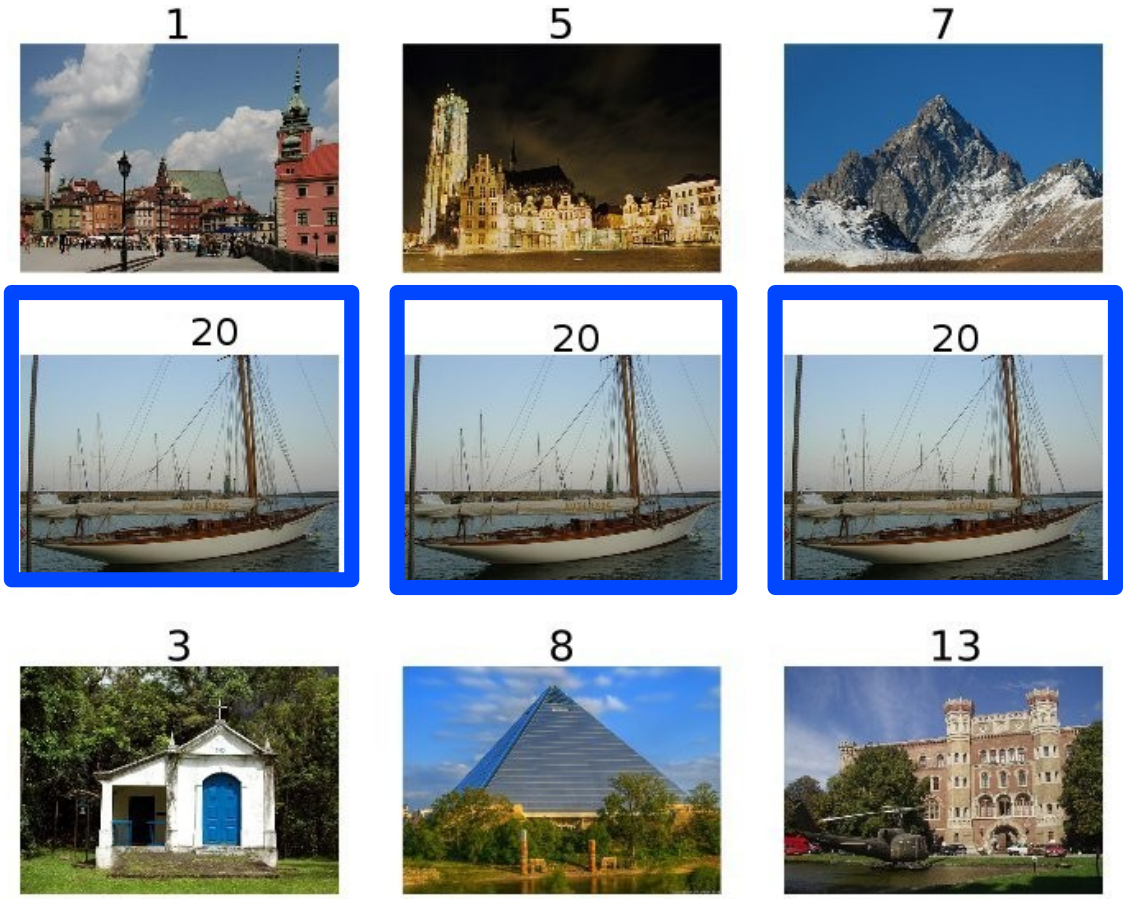
- fine the system that takes more than one duplicate image
- subtract weighted score for duplicate images



System 1:
1 + 20 + 8 = 29 Points

System 2:
1 + 20 - 1*1/3*20 = 7.6 Points

System 3:
20 - 2*1/3*20 = 6.6 Points

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4. Conclusion

- briefly presentation of our approach of photo summarization
- images are rated based on various criteria
- most suitable images are selected for the summary

- different possibilities of evaluation were mentioned
- our evaluation approach is based on ground truth data
- allows instant rating and comparison

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Thank you for your attention!

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