

## D-Meta.ai 과제 전형

Solution Introduction



Developer : 김영준

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Task Overview

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Explanation on Impossibility

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1

Task Overview

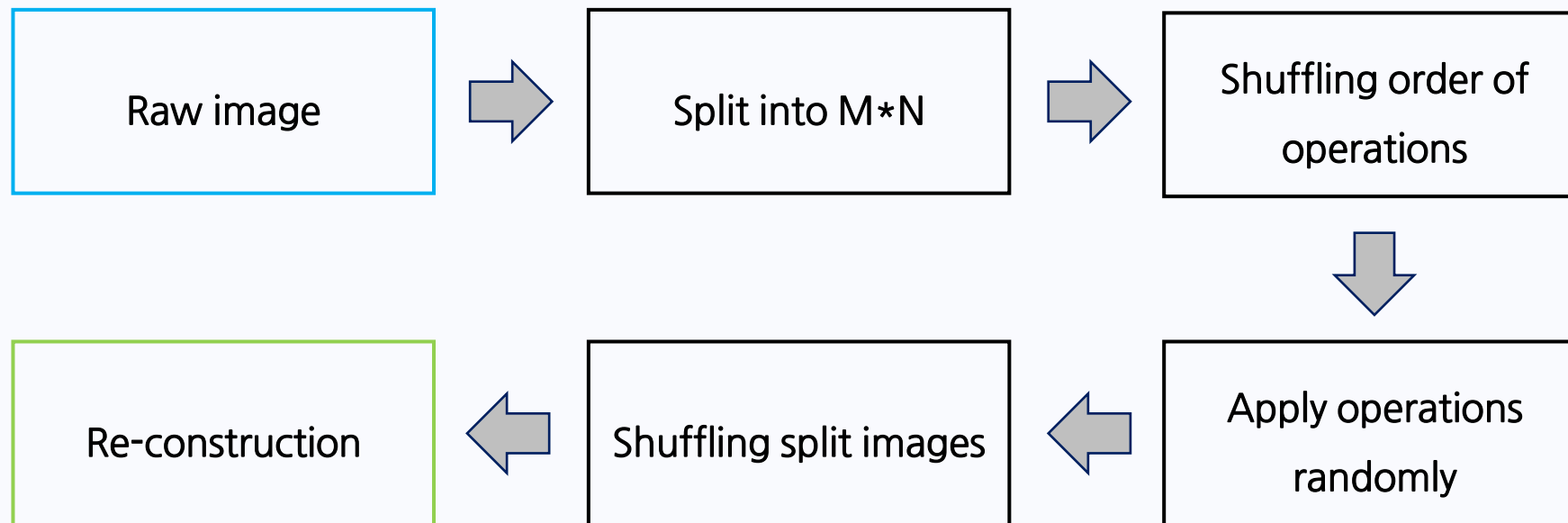
2

Explanation on Impossibility

3

Solution

I should develop the re-construction algorithm from split images to a complete image



But, I felt there are **some points very unrealistic** in implementing the merging stage

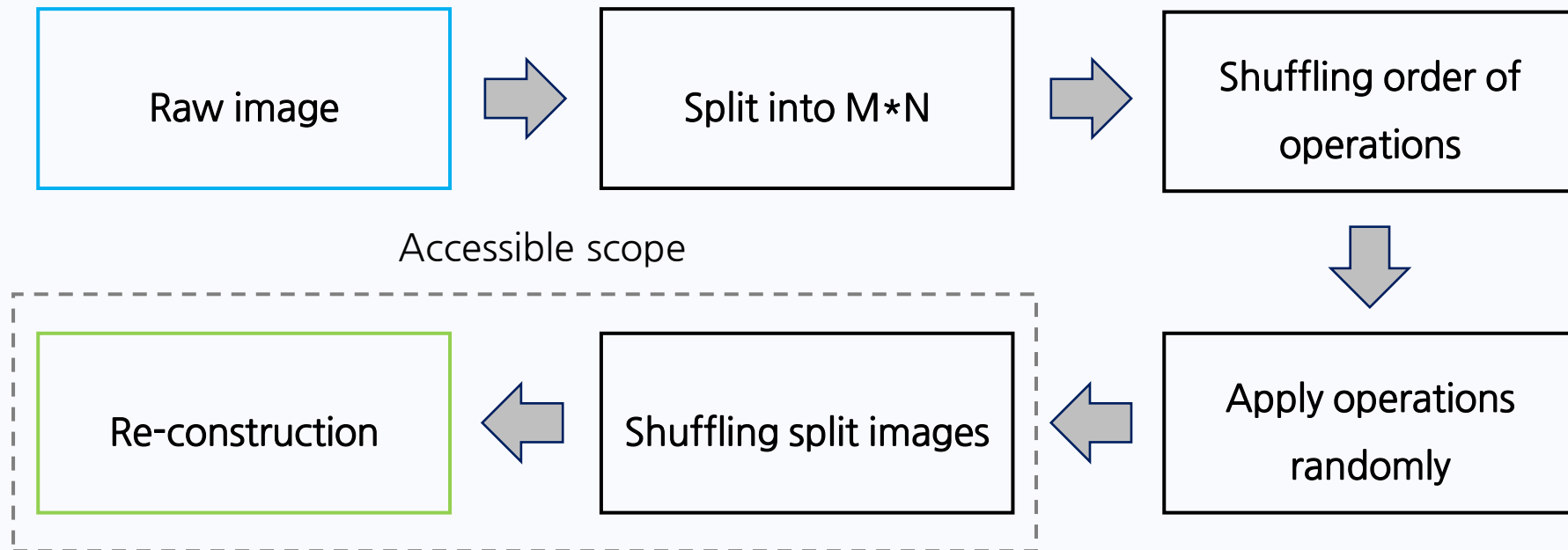
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1 I can't use prior information on the original image

➡ This means I must **optimize to some best cases** not train patterns with complete image



2 I don't know generally used algorithm matching two images without overlapping

➡ I can't use the algorithm carrying out very efficiently, I can only use traditional algorithms



Binarization

HOG

LBP

3 This process **require very huge time complexity**

➡ This third reason is very critical.. Below is the number of search spaces in optimization stage

$$(2^O \cdot O!)^{M \cdot N} \times (M \cdot N)!$$

Where O is the number of operations,  
M is the number of grids on height,  
N is the number of grids on width,



3 This process **require very huge time complexity**

➔ This third reason is very critical.. Below is the number of search spaces in optimization stage

$$(2^O \cdot O!)^{M \cdot N} \times (M \cdot N)!$$



The number of cases which apply random operations with random order



The number of images which operations are applied



The number of permutation which determine the order of images

3 This process **require very huge time complexity**

➡ This third reason is very critical.. Below is the number of search spaces in optimization stage

$$(2^O \cdot O!)^{M \cdot N} \times (M \cdot N)!$$



✓ This part is  $O(n!)$ , which let the search spaces increase dramatically

If  $(M \cdot N)$  is 25, then I must find 4 best spaces in  $1.551121e + 25$  search spaces !

So, I decide to remove this part for reducing complexity which would make it impossible to converge in finite time !

3 This process **require very huge time complexity**

➔ This third reason is very critical.. Below is the number of search spaces in optimization stage

$$(2^O \cdot O!)^{M \cdot N} \times (M \cdot N)! \Rightarrow (2^O \cdot O!)^{M \cdot N}$$

✓ Then, the order of the images has already been determined

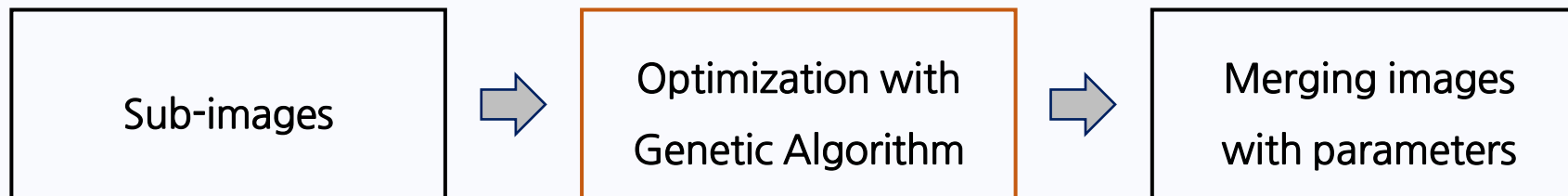
# Contents

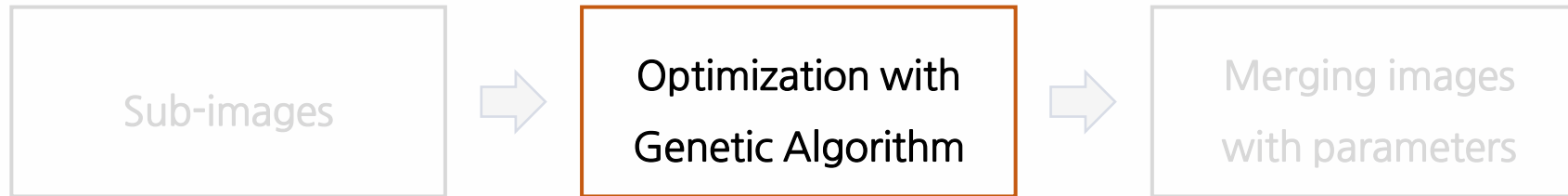


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The core part of my solution is using Genetic Algorithm(GA) in optimization

✓ Optimize the parameters used in merging images





Components of objective functions

L2 distance of pixels

L2 distance of  
LBP & HOG feature

L2 distance of pixel histogram

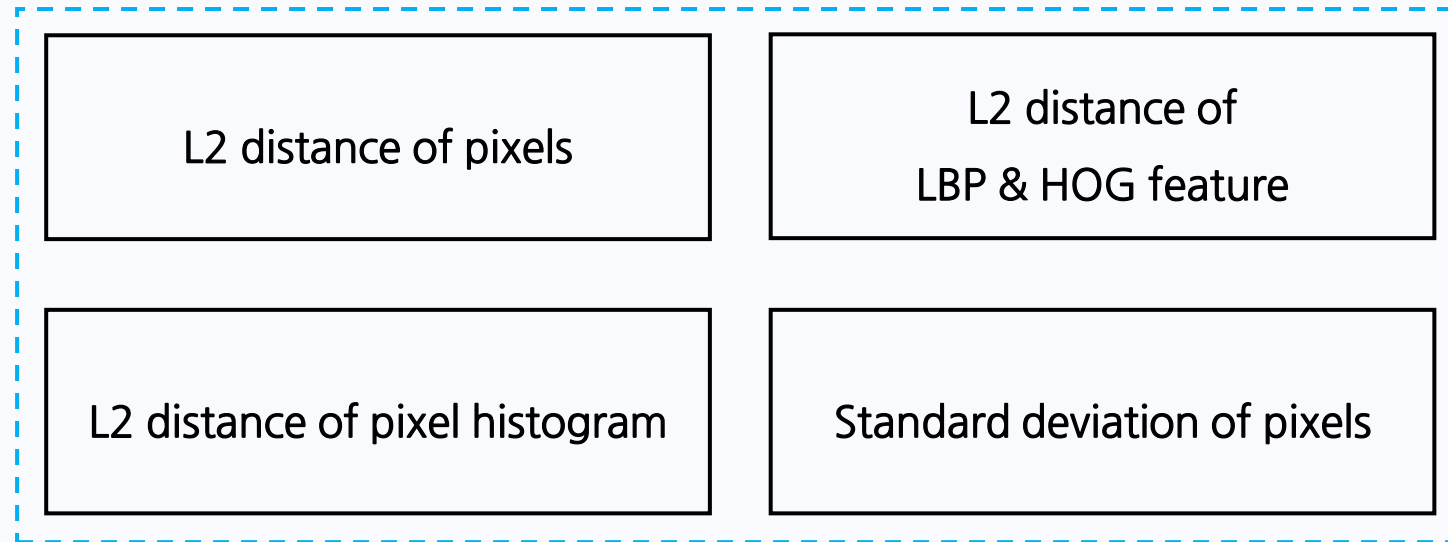
Standard deviation of pixels

Difference of LBP feature  
between local and global

Difference of Binarization feature  
between local and global

- ✓ Below algorithms are used calculating **naturalness on edge side**

## Local Feature Extractor



- ✓ Below algorithms are used calculating naturalness in case of complete image

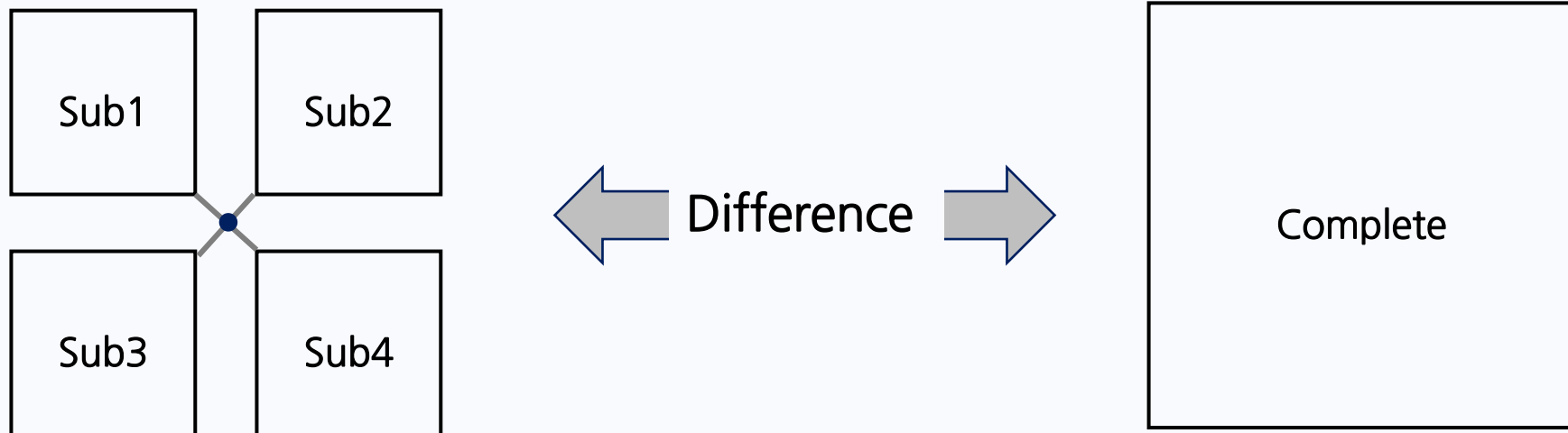
### Global Feature Extractor

Difference of LBP feature  
between local and global

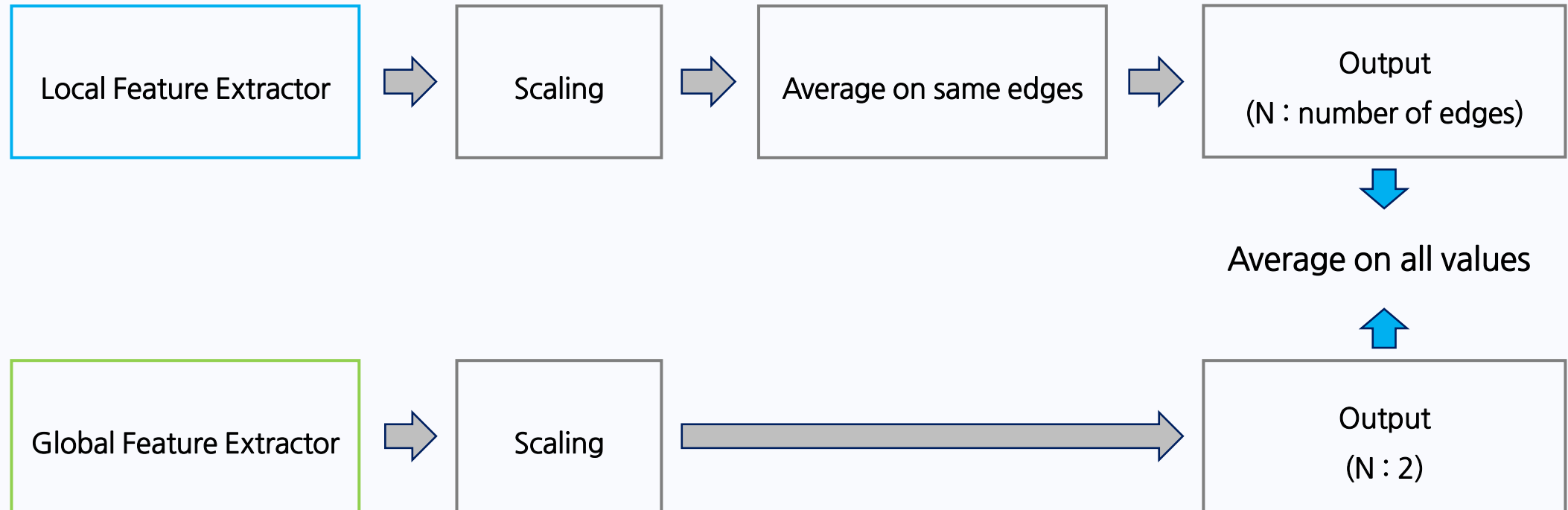
Difference of Binarization feature  
between local and global



- ✓ This operation **let objective function consider global naturalness** with local naturalness



✓ This operation **let objective function consider global naturalness** with local naturalness



## ✓ Hyper parameters of Genetic Algorithm

Max iteration : 10,000

Population size : 50

Mutation probability : 5%

Crossover probability : 80%

Swapping probability : 50%

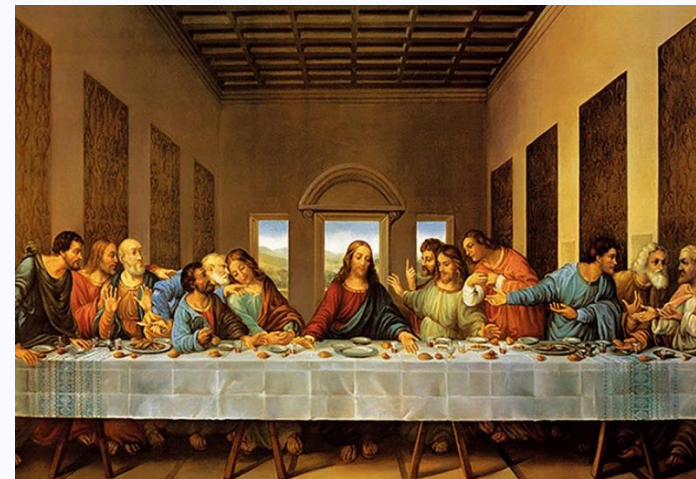
## ✓ Missed tiles (Only 1 tile is missed !)

M by N	Case1	Case2
2 by 2	0	0
2 by 3	0	0
3 by 3	0	0
4 by 4	0	0
5 by 5	1	0



➡ Case1

505 by 511

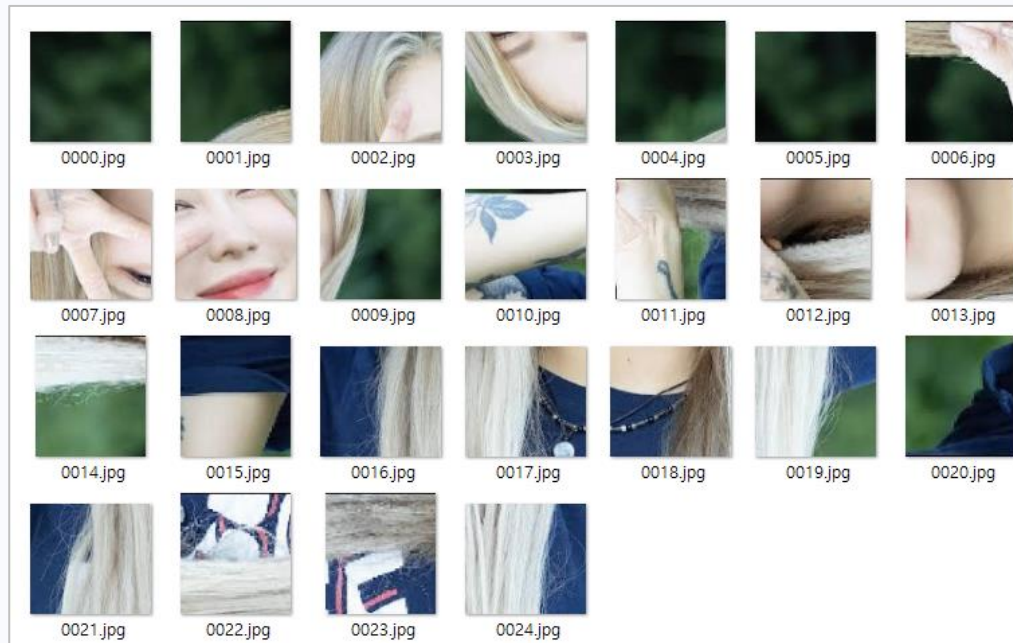


➡ Case2

551 by 800

This architecture shows robustness on different type of image !

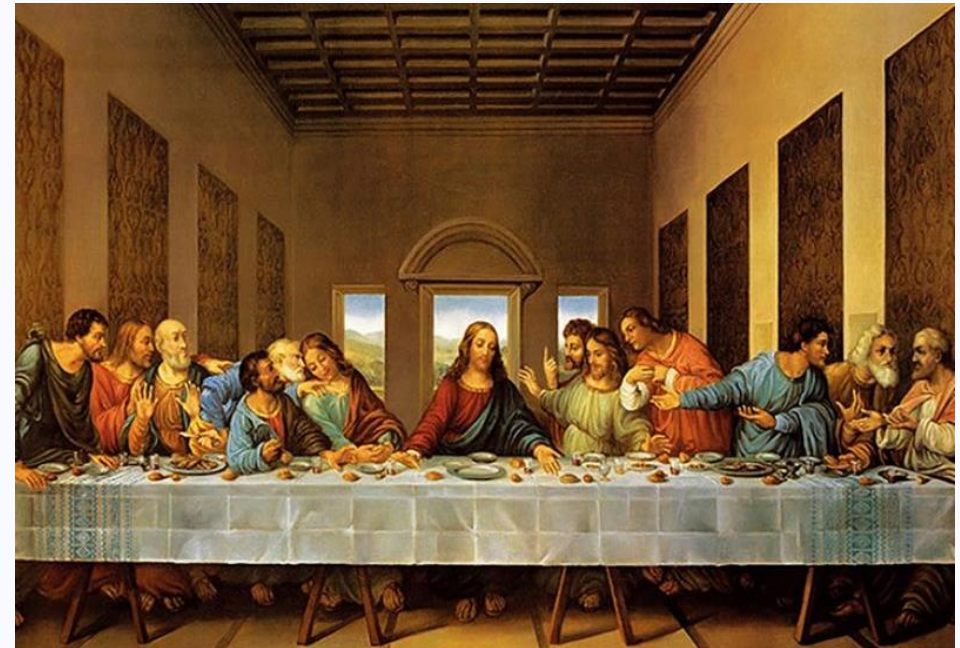
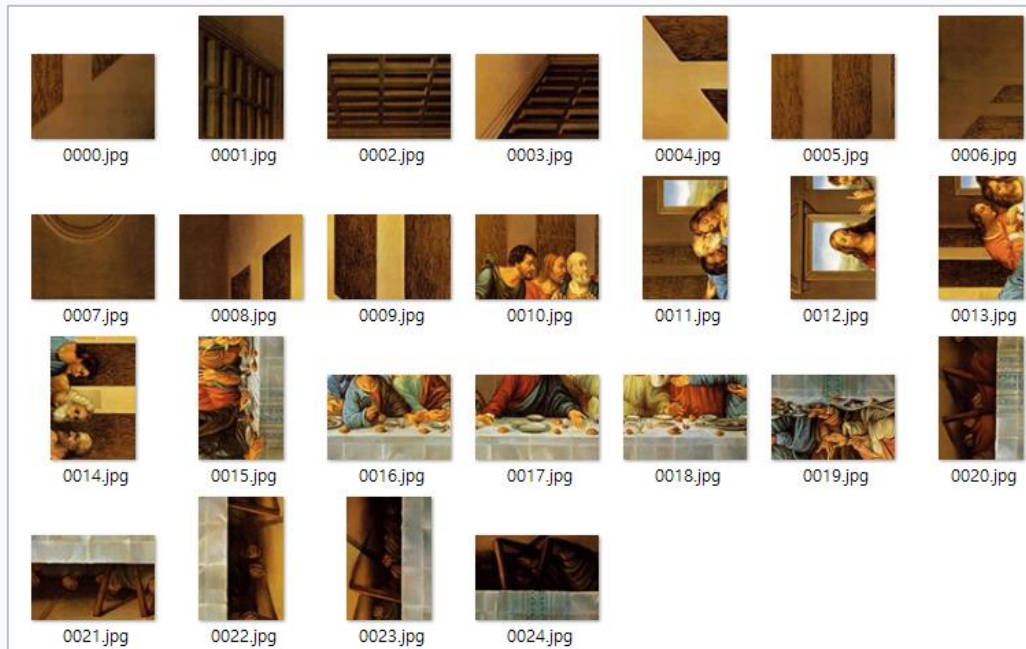
- ✓ Case1. The picture with low complexity, background is certainly separated from the person located in center





How about more complex picture? - The Last Supper of Leonardo da Vinci

- ✓ Case2. The picture with high complexity, there are many people and the picture has diverse colors



Thank You

The End

