FEATURE EXTRACTION

2D-3D Image&Sound

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1ST ACTIVITY: IMAGE CLASSIFICATION PIPELINE

Start with an example

By group of 2 or 3
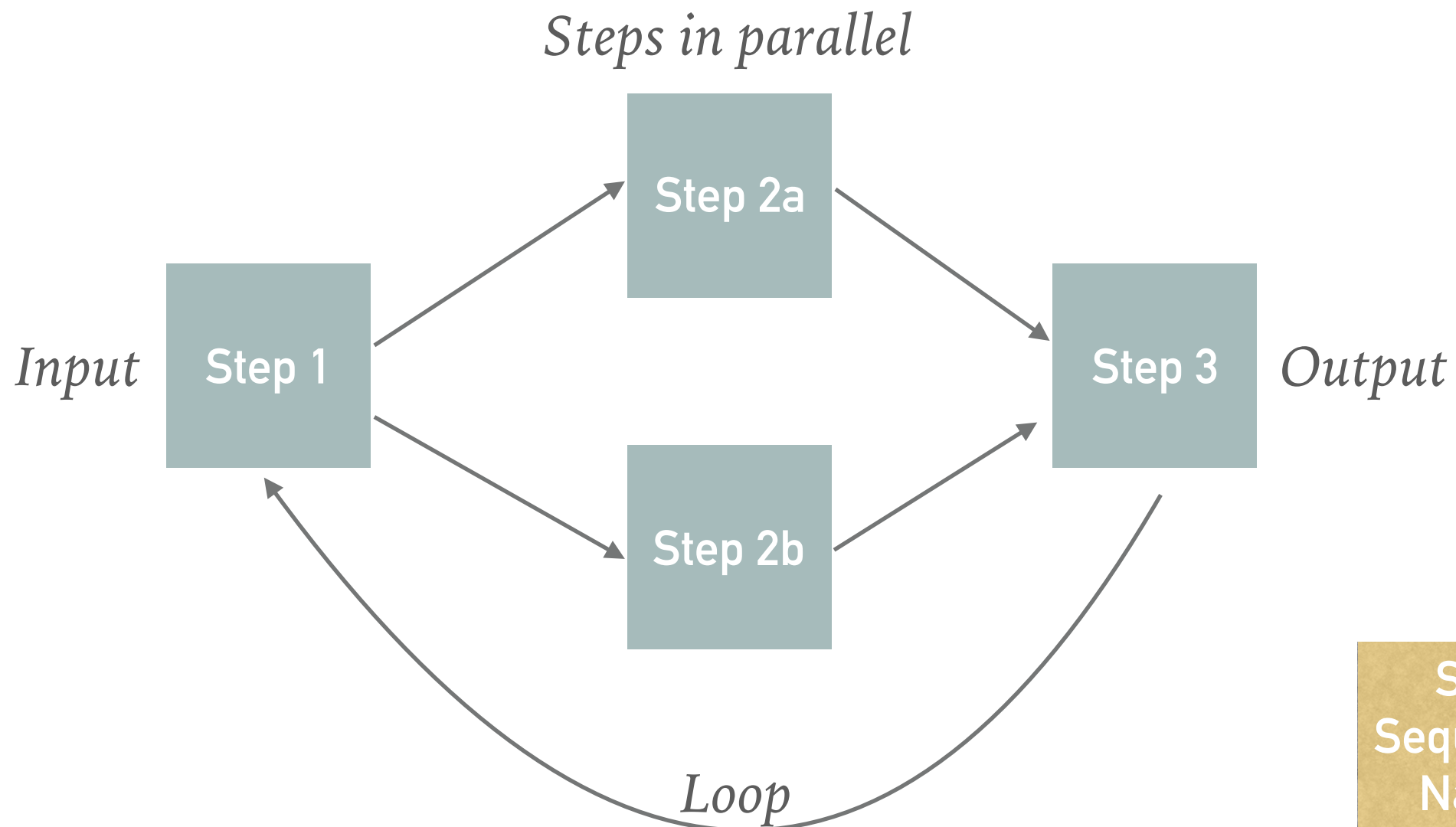
Imagine a solution to automatically classify those images

From what you already know

1ST ACTIVITY: IMAGE CLASSIFICATION PIPELINE

Draw a scheme with the generic pipeline of image classification

Steps in parallel

Step 2a

Input   Step 1   Step 3   Output

Step 2b

Loop

Steps?
Sequencing?
Names?
Input?
Output?

1ST ACTIVITY: IMAGE CLASSIFICATION PIPELINE

Image → **Pre-processing** → **Feature extraction** → **Classification** → *Label*

Example of pre-processing: denoising

1ST ACTIVITY: IMAGE CLASSIFICATION PIPELINE
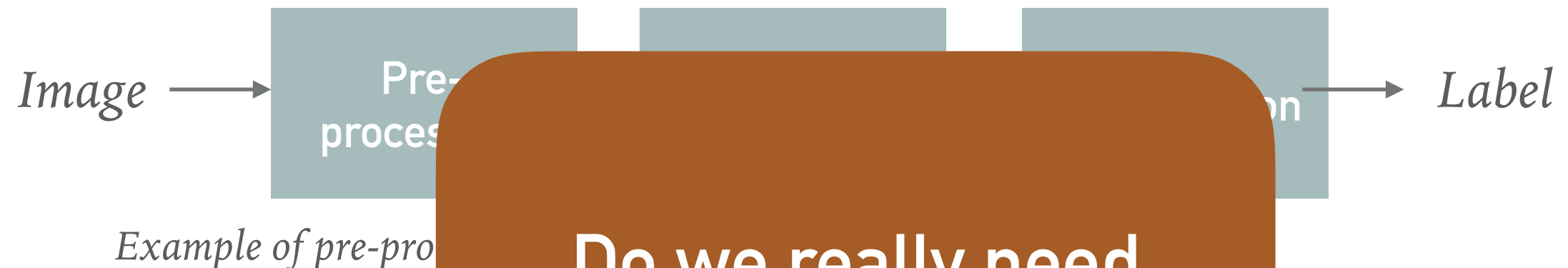

Testing time

Image → Pre-processing → Feature extraction → Classification → Label

Example of pre-processing: denoising

Learning time

Images → Pre-processing → Feature extraction → Learning → Model

Labels

Each image has one label (example: forest)

1ST ACTIVITY: IMAGE CLASSIFICATION PIPELINE

Testing time

Image → Pre-processing ... on → *Label*

Example of pre-pro...

Learning time

Do we really need labels for this task?

Images → Pre-processing → Feature extraction → Learning → *Model*
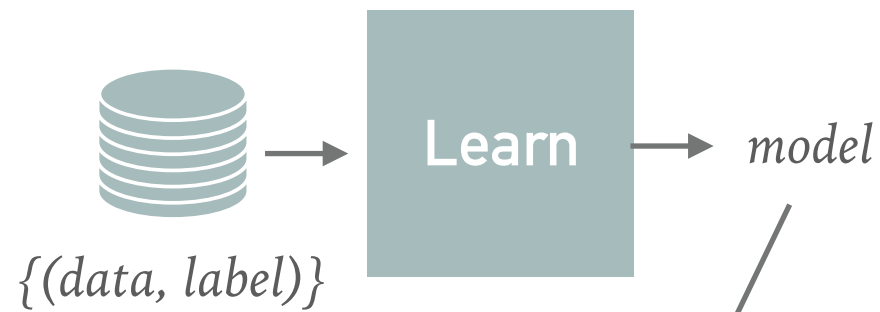
Each image has one label (example: forest)

SUPERVISED VERSUS UNSUPERVISED LEARNING

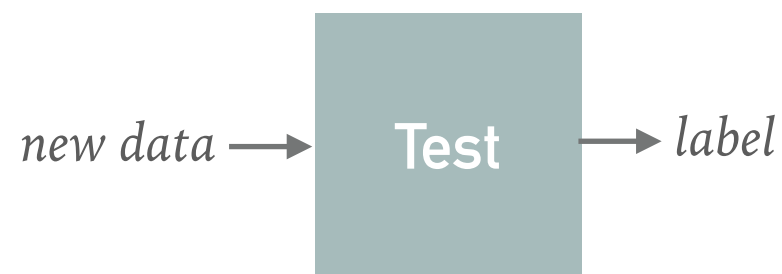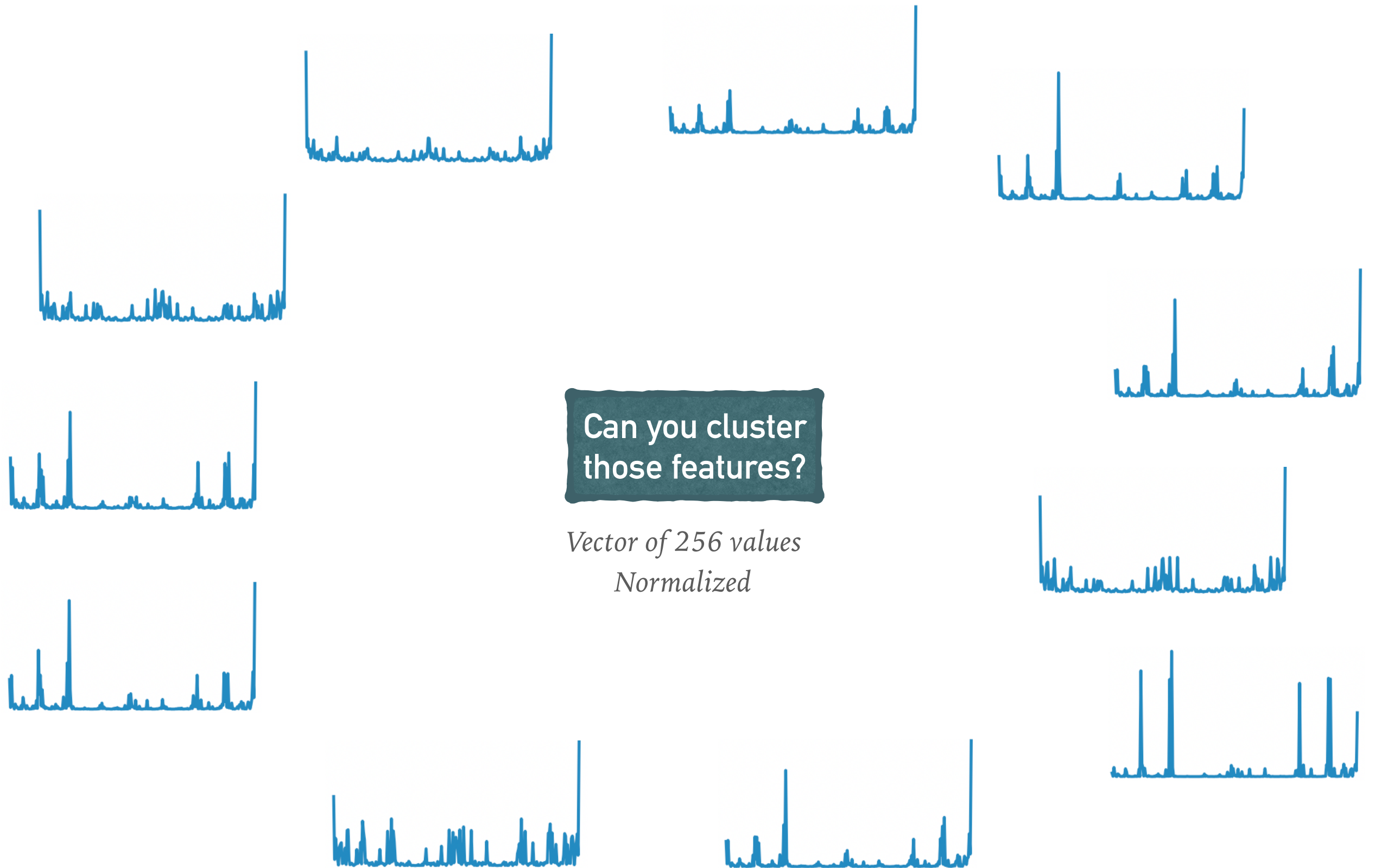**Classification versus clustering** 监督与半监督，分类与聚类

Train

{(data, label)} → Learn → *model*

{data} → Learn → *model + clusters {(data, cluster)}*

Test

new data → Test → *label*

new data → Test → *cluster*
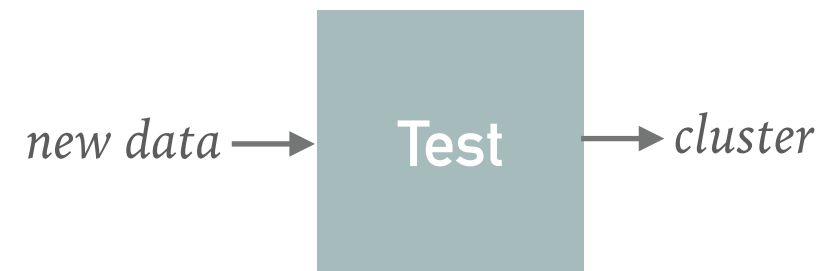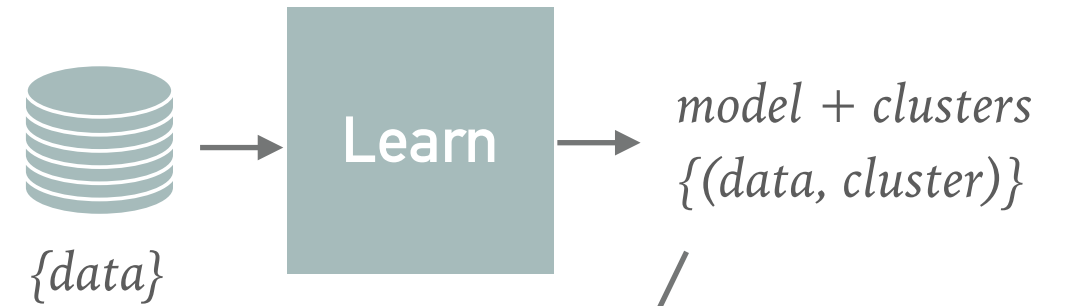
2ND ACTIVITY: WHAT IS THE MOST DIFFICULT STEP?

Image → **Pre-processing** → **Feature extraction** → **Classification / Clustering** → *Label/cluster*

FEATURE EXTRACTION TO GET RELEVANT INFORMATION

Can you cluster
those features?

*Vector of 256 values
Normalized*

3RD ACTIVITY: LBP HISTOGRAM

LBP: Local Binary Pattern

125	124	123
124	**123**	121
122	120	123

Difference →

2	1	0
1	■	–2
–1	–3	0

Local: 3*3 windows

Sign ↓

151

1	1	1
1	■	0
0	0	1

10010111

Binary information: 11101001

Pattern: edges

Weights ↓

1	2	4
128	■	8
64	32	16

→

1	2	4
128	■	0
0	0	16
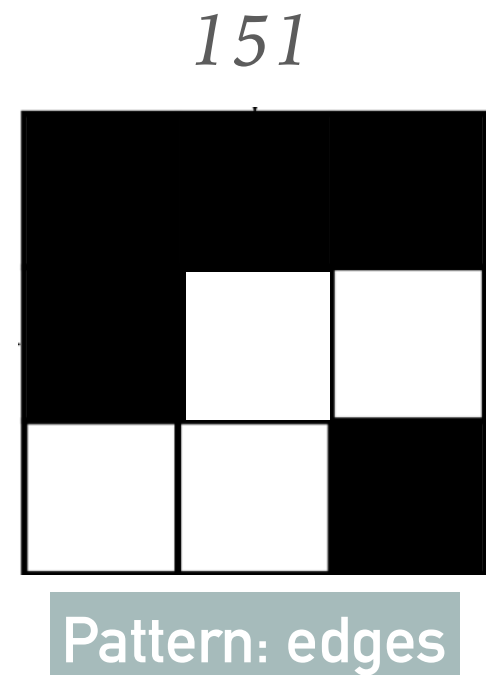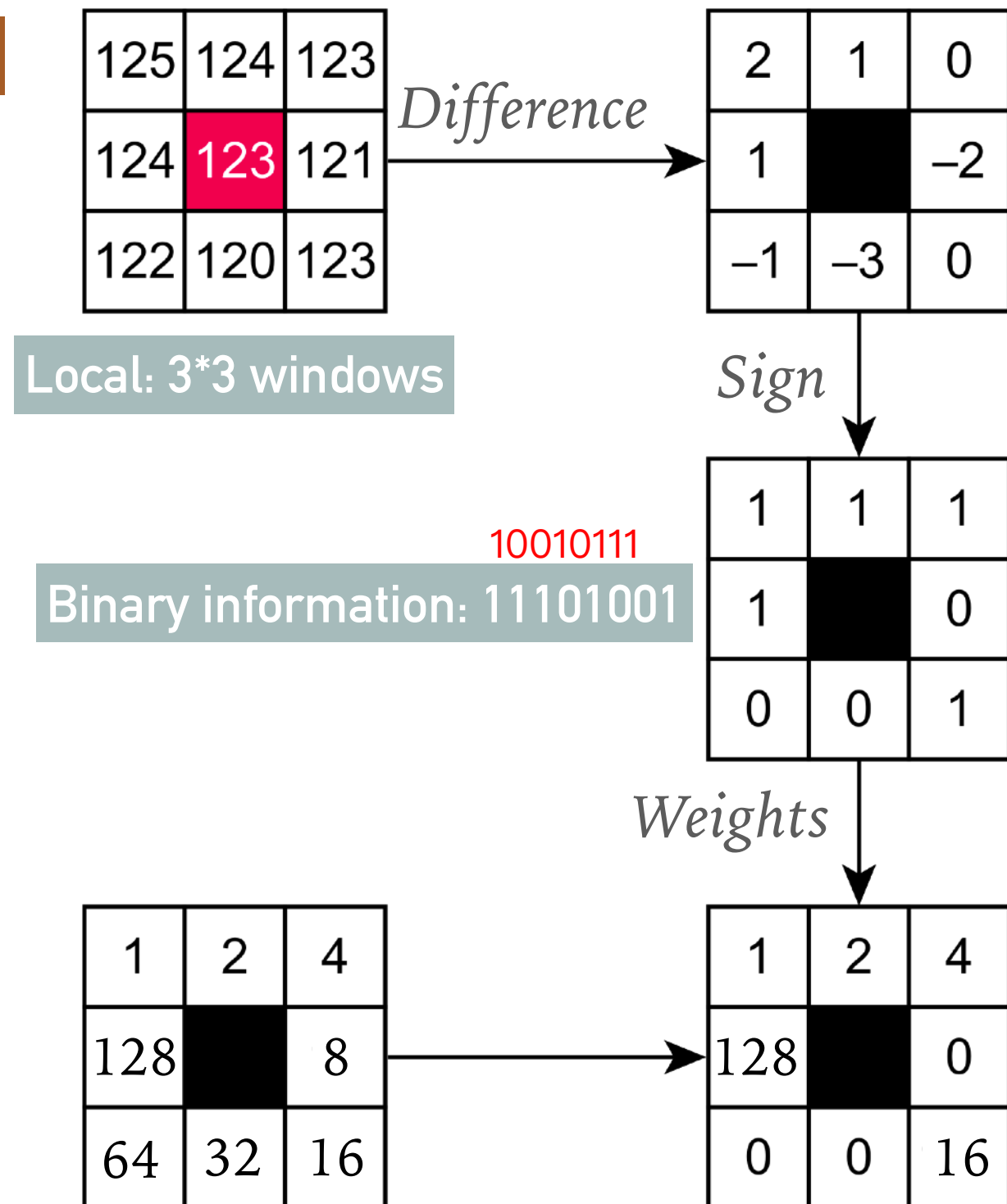
LBP = 1 + 2 + 4 + 16 + 128 = 151

3RD ACTIVITY: LBP HISTOGRAM

What are the most frequent LBP you will expect…

    … in an image of a forest

    … in an image of the sea?
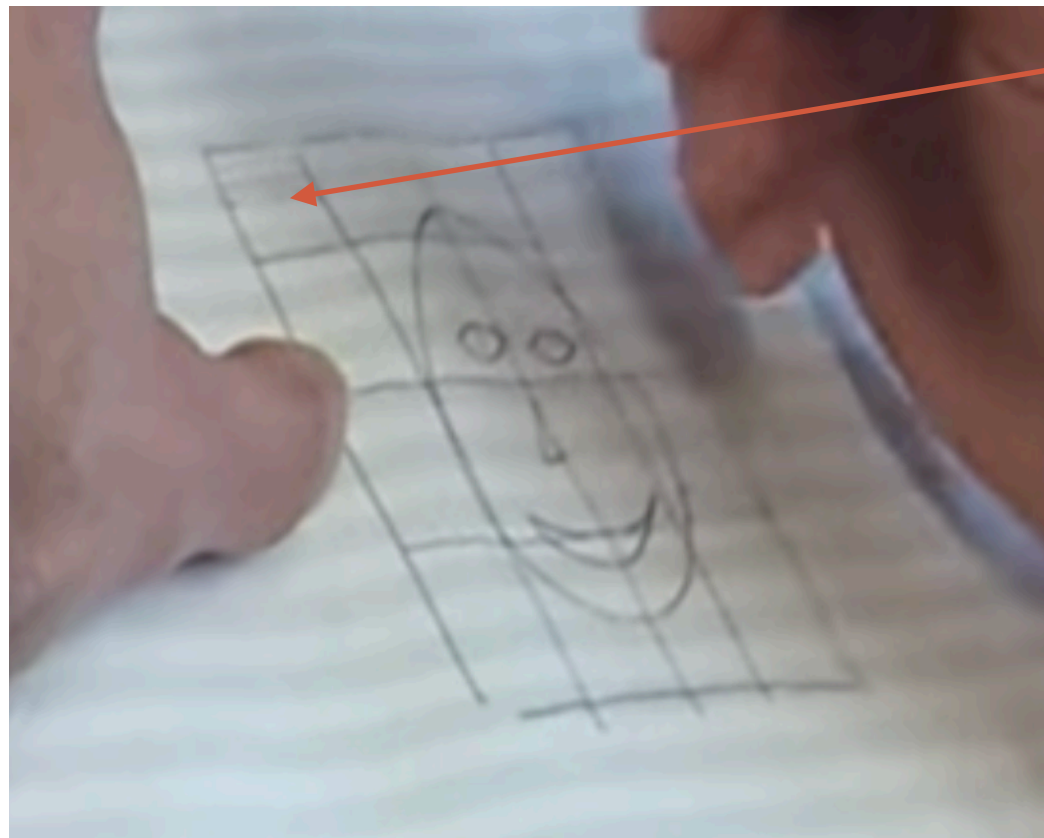
LBP histogram

1 cell ➡ *many LBP values* ➡ *1 histogram*

0   *255*

In our example, we will take: 1 image <->1 cell <-> 1 histogram
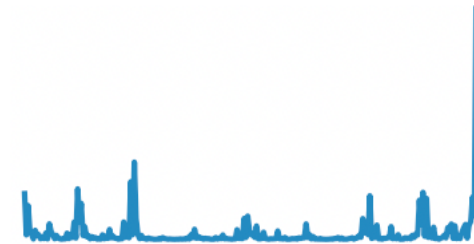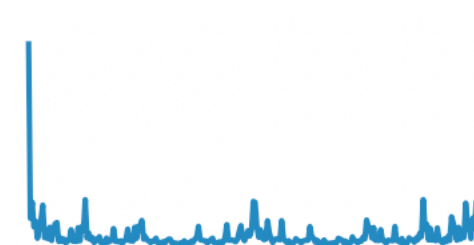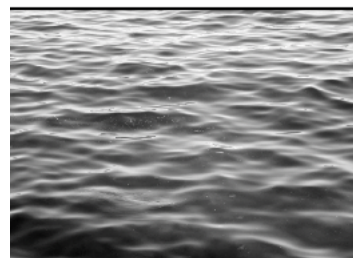
Let's experiment!

5TH ACTIVITY: WHY DEEP LEARNING IS SO IMPORTANT IN IMAGE CLASSIFICATION?

Testing time

Image → **Pre-processing** → **Feature extraction** → **Classification** → Label

Example of pre-processing: denoising

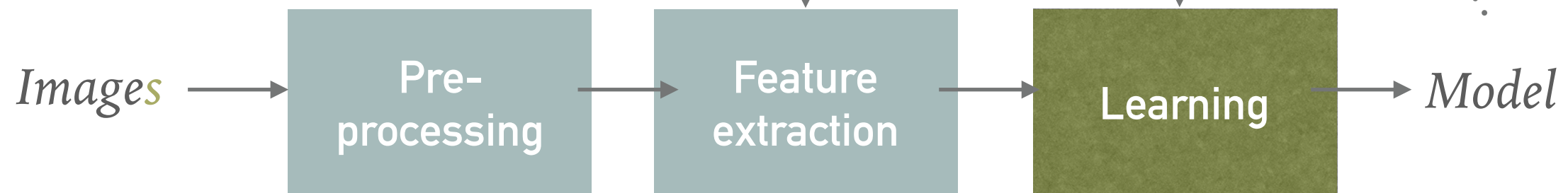# 5TH ACTIVITY: WHY DEEP LEARNING IS SO IMPORTANT IN IMAGE CLASSIFICATION?

Testing time

Image → Pre-processing → Feature extraction → Classification → Label

Example of pre-processing: denoising

Algorithm

Learning time

Images → Pre-processing → Feature extraction → Learning → Model

Labels

Each image has one label (example: forest)

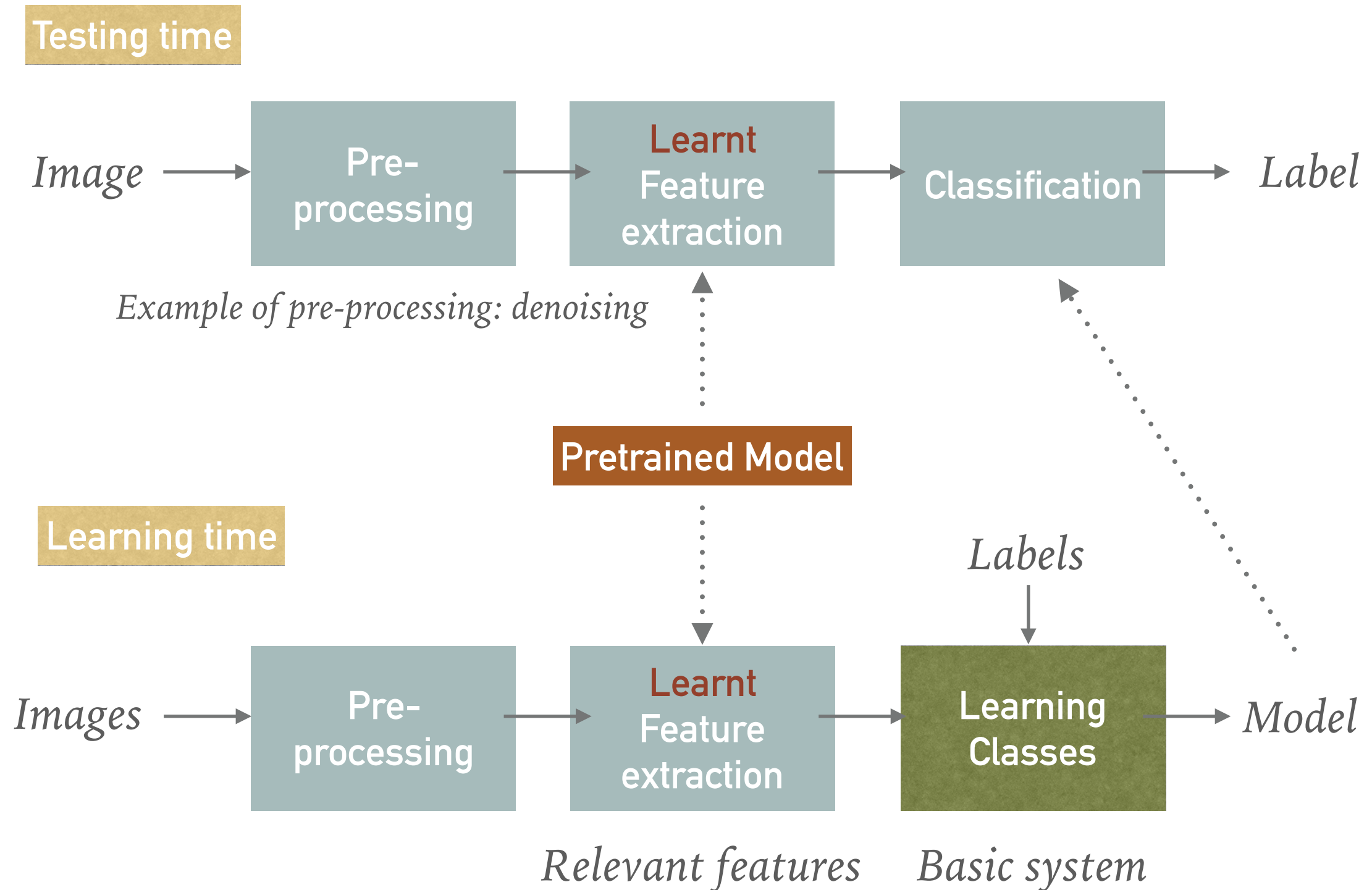# WHY DEEP LEARNING IS SO IMPORTANT IN IMAGE CLASSIFICATION?
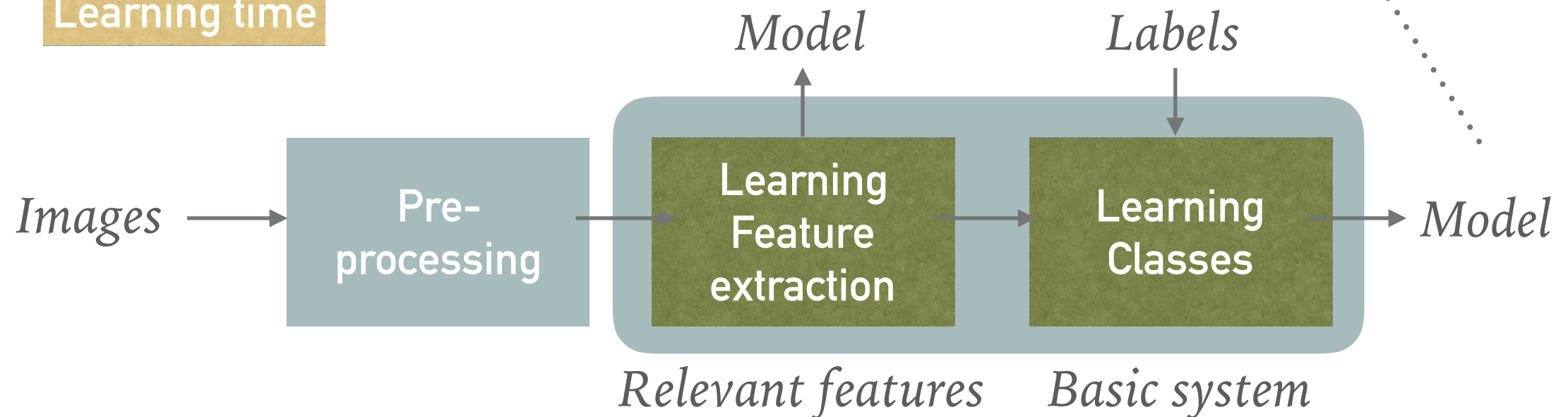
5TH ACTIVITY: TRANSFER LEARNING

Testing time

Image → Pre-processing → Learnt Feature extraction → Classification → *Label*

Example of pre-processing: denoising

Pretrained Model

Learning time

Images → Pre-processing → Learnt Feature extraction → Learning Classes → *Model*

Labels

Relevant features   *Basic system*

MAIN MESSAGES

➤ An image processing pipeline is most of the time composed of pretreatment, feature extraction, processing (clustering, classification, regression, …)

➤ Feature extraction is a key part of the process. The most relevant the feature for the task, the better.

➤ LBP is one example of relevant feature.

➤ Deep learning process learns not only the "classifiers" but also the relevant features! CNN，既学习特征提取，也学习分类

➤ One can used pre-trained features learnt by a Deep Learning process. This is called Transfer Learning.

QUESTIONS & FEEDBACK