
Pattern Recognition

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Term Project

- **Before Starting**

- <https://github.com/sejongresearch/2019.Fall.PatternRecognition/issues/27>

- **Subject**

- <https://github.com/sejongresearch/2019.Fall.PatternRecognition/issues/12>
- Image classification using Pattern Recognition
- Beyond bags of features spatial pyramid matching for recognizing natural scene categories, CVPR 2006

- **Competition using Kaggle**

- <https://www.kaggle.com/c/2019-fall-ml-project/overview>
- Baseline: Coming Soon
- Activation: 11/11~

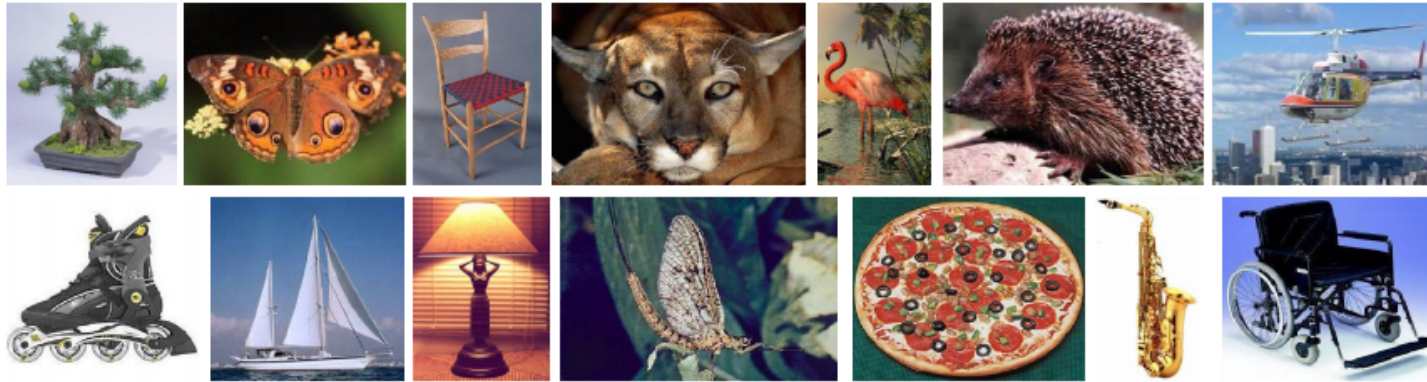
Term Project

- Baseline

Caltech101 dataset

Fei-Fei et al. (2004)

http://www.vision.caltech.edu/Image_Datasets/Caltech101/Caltech101.html



Multi-class classification results (30 training images per class)

Default →

	Weak features (16)		Strong features (200)	
Level	Single-level	Pyramid	Single-level	Pyramid
0	15.5 \pm 0.9		41.2 \pm 1.2	
1	31.4 \pm 1.2	32.8 \pm 1.3	55.9 \pm 0.9	57.0 \pm 0.8
2	47.2 \pm 1.1	49.3 \pm 1.4	63.6 \pm 0.9	64.6 \pm 0.8
3	52.2 \pm 0.8	54.0 \pm 1.1	60.3 \pm 0.9	64.6 \pm 0.7

Term Project

- Baseline

Scene category dataset

Fei-Fei & Perona (2005), Oliva & Torralba (2001)

http://www-cvr.ai.uiuc.edu/ponce_grp/data



Multi-class classification results (100 training images per class)

	Weak features (vocabulary size: 16)		Strong features (vocabulary size: 200)	
Level	Single-level	Pyramid	Single-level	Pyramid
0 (1×1)	45.3 \pm 0.5		72.2 \pm 0.6	
1 (2×2)	53.6 \pm 0.3	56.2 \pm 0.6	77.9 \pm 0.6	79.0 \pm 0.5
2 (4×4)	61.7 \pm 0.6	64.7 \pm 0.7	79.4 \pm 0.3	81.1 \pm 0.3
3 (8×8)	63.3 \pm 0.8	66.8 \pm 0.6	77.2 \pm 0.4	80.7 \pm 0.3

Default →

Fei-Fei & Perona: 65.2%

Term Project

- Reference Tools

- VLFEAT Library

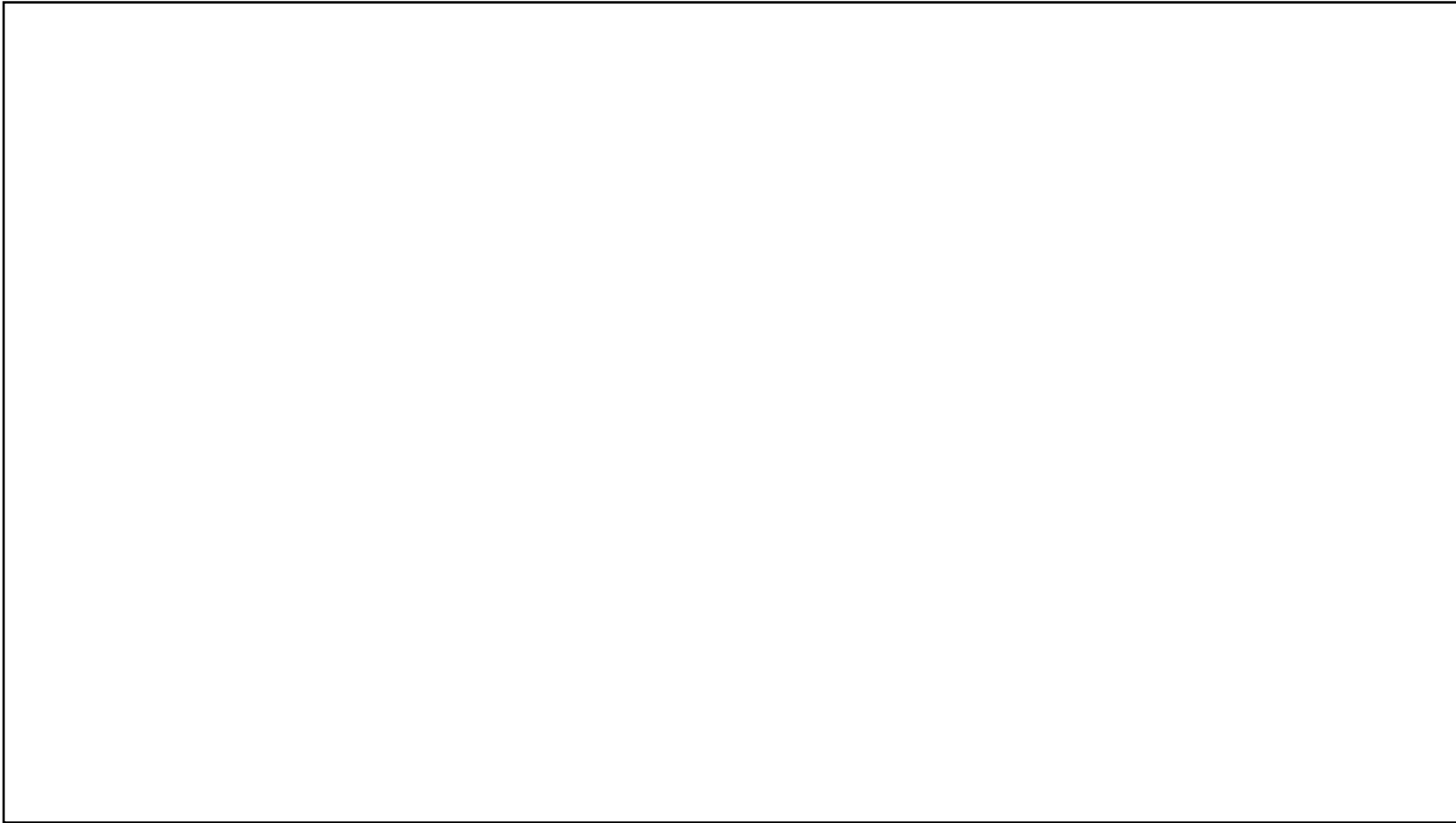
- <http://www.vlfeat.org/index.html>
 - <http://www.vlfeat.org/applications/apps.html#apps.caltech-101>

- Program Language

- Python + Colab or Your Env.
 - You should submit the **kernel** in the Kaggle.

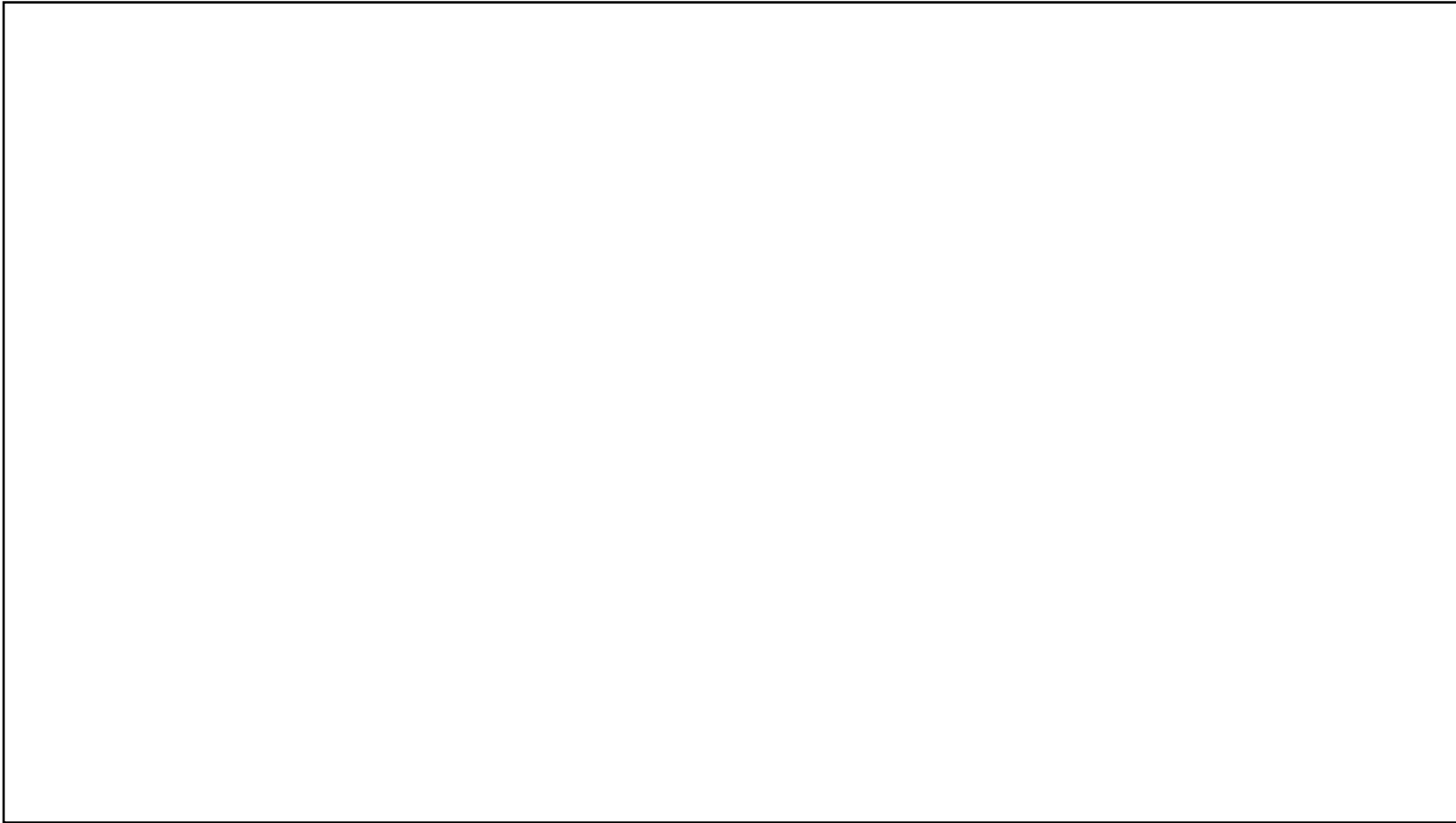
Goal

- Image classification using Pattern Recognition



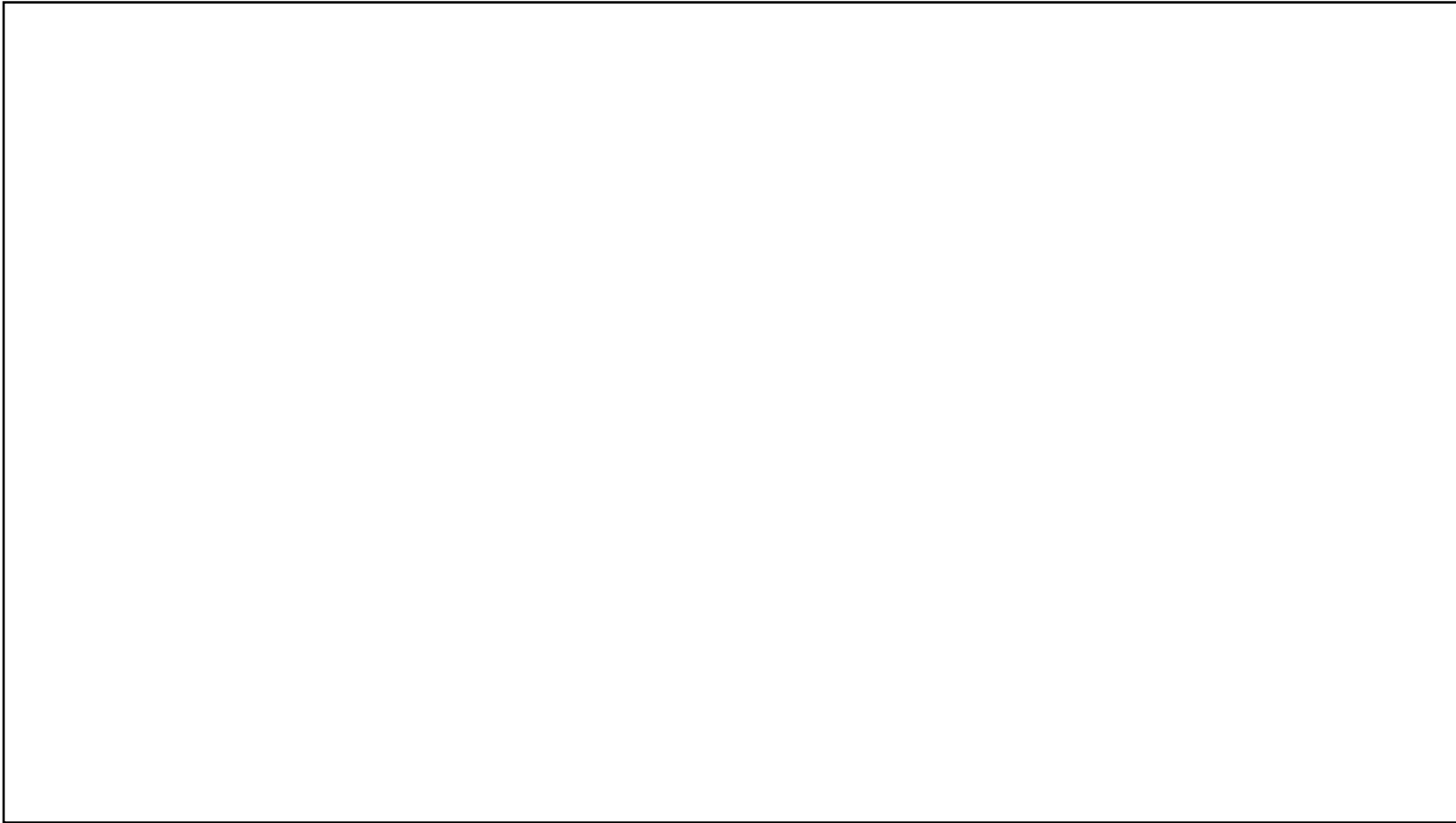
Goal

- Image classification using Pattern Recognition

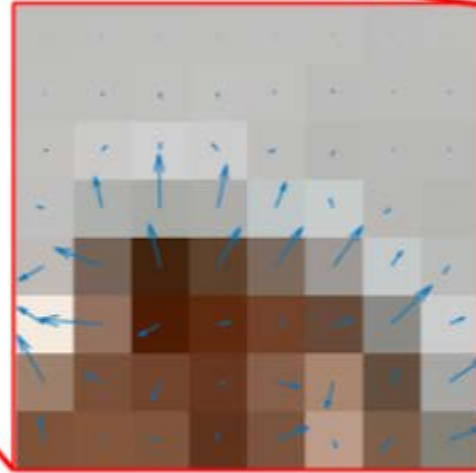
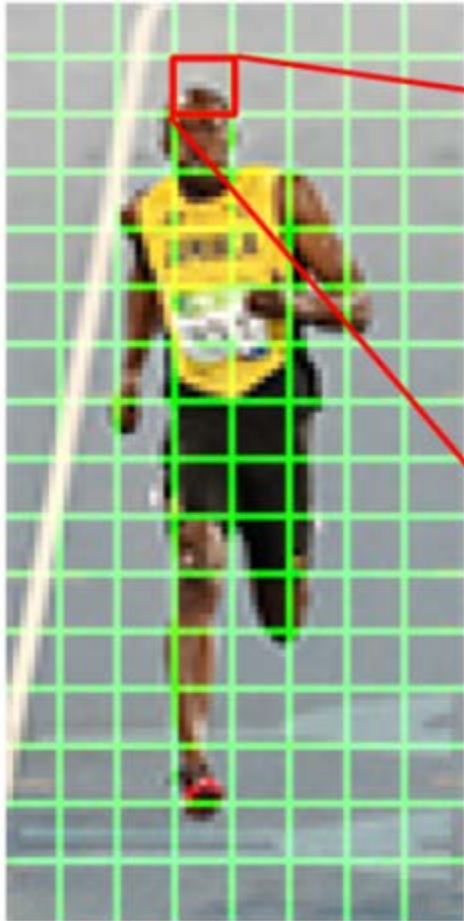


Goal

- Image classification using Pattern Recognition



Gradient



2	3	4	4	3	4	2	2
5	11	17	13	7	9	3	4
11	21	23	27	22	17	4	6
23	99	165	135	85	32	26	2
91	155	133	136	144	152	57	28
98	196	76	38	26	60	170	51
165	60	60	27	77	85	43	136
71	13	34	23	108	27	48	110

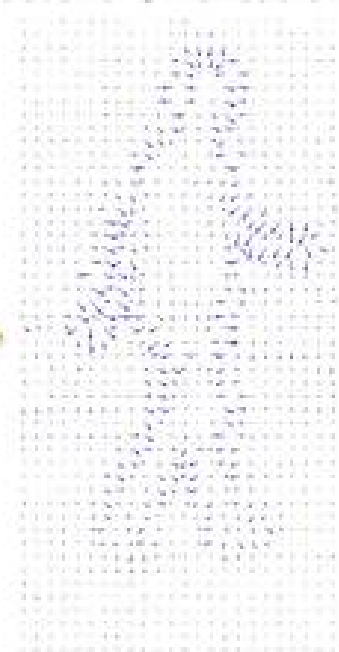
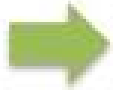
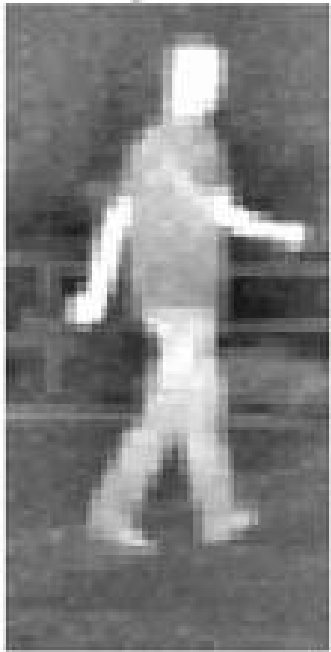
Gradient Magnitude

80	36	5	10	0	64	90	73
37	9	9	179	78	27	169	166
87	136	173	39	102	163	152	176
76	13	1	168	159	22	125	143
120	70	14	150	145	144	145	143
58	86	119	98	100	101	133	113
30	65	157	75	78	165	145	124
11	170	91	4	110	17	133	110

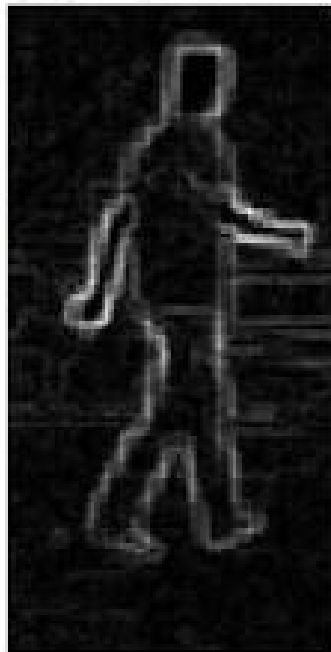
Gradient Direction

가운데 : 화살표를 사용하여 RGB 패치와 그라디언트를 나타냅니다. 오른쪽 : 동일한 패치의 그라디언트가 숫자로 표시됩니다.

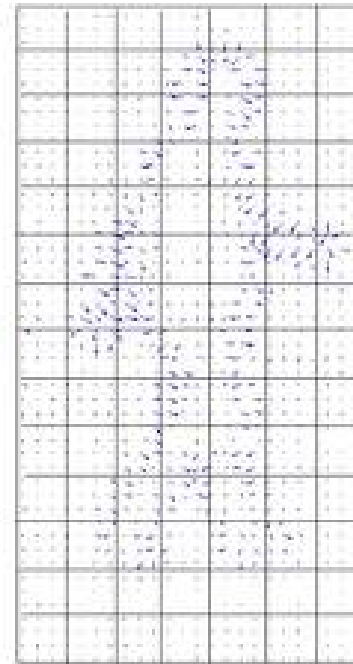
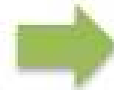
HOG(Histogram of Oriented Gradient)



gradient
orientation



gradient
magnitude



histogram of
gradient orientation

1. Clustering

- Voice
 - <https://musicinformationretrieval.com/kmeans.html>
 - ??
 - Voice → Feature Extractor → Kmeans
- Images
 - VLFEAT
 - Images → Feature Extractor → Kmeans
 - Visual Bag of words