Deep Learning

Classification café using image clustering

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Topic Selection

Topic Selection

- *Like "Instagram Atmosphere Café" interior and atmosphere are important factors in individual cafe selection.*
  An important factor in individual cafe selection.
- *Each individual has a preferred atmosphere, but it takes a lot of time to find a cafe that suits their taste.*
- **hyper-personalization**

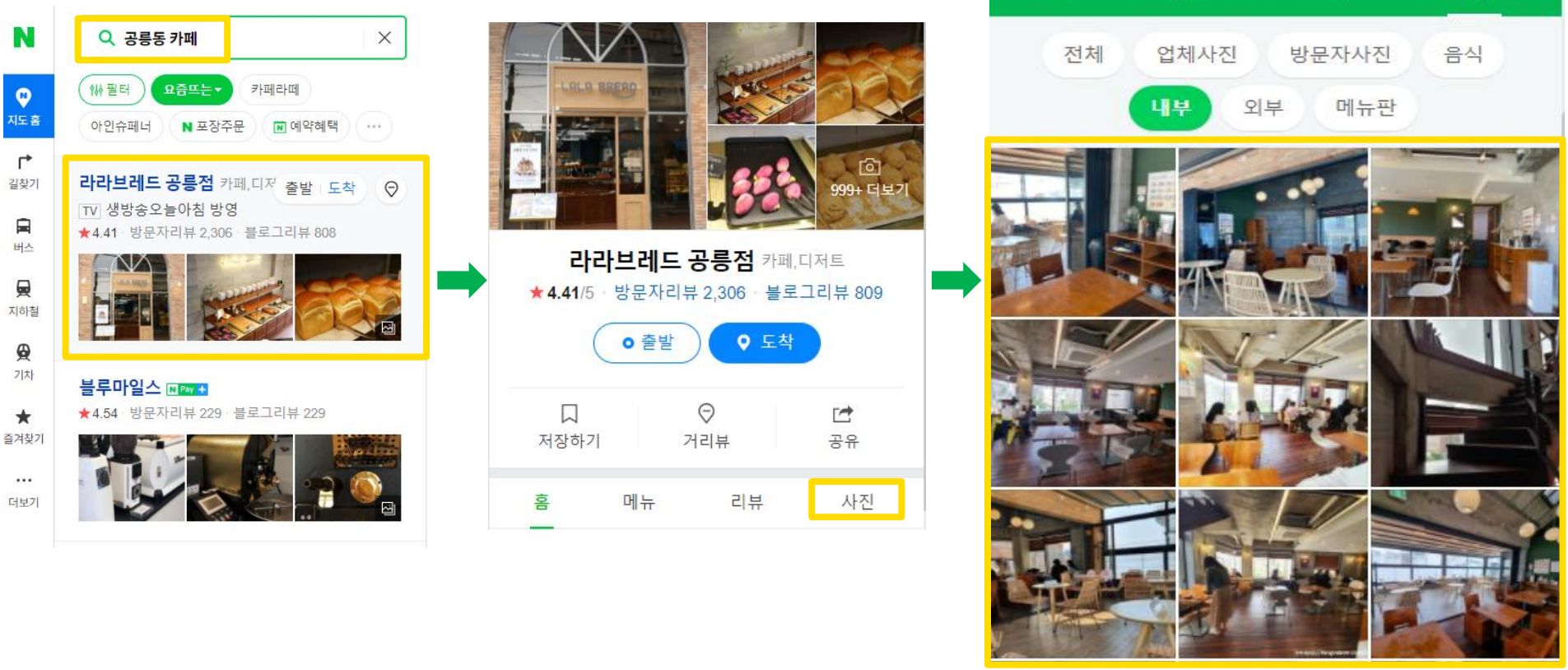
➡ *Cafe classification through interior image clustering*

Data Collection

Data Collection

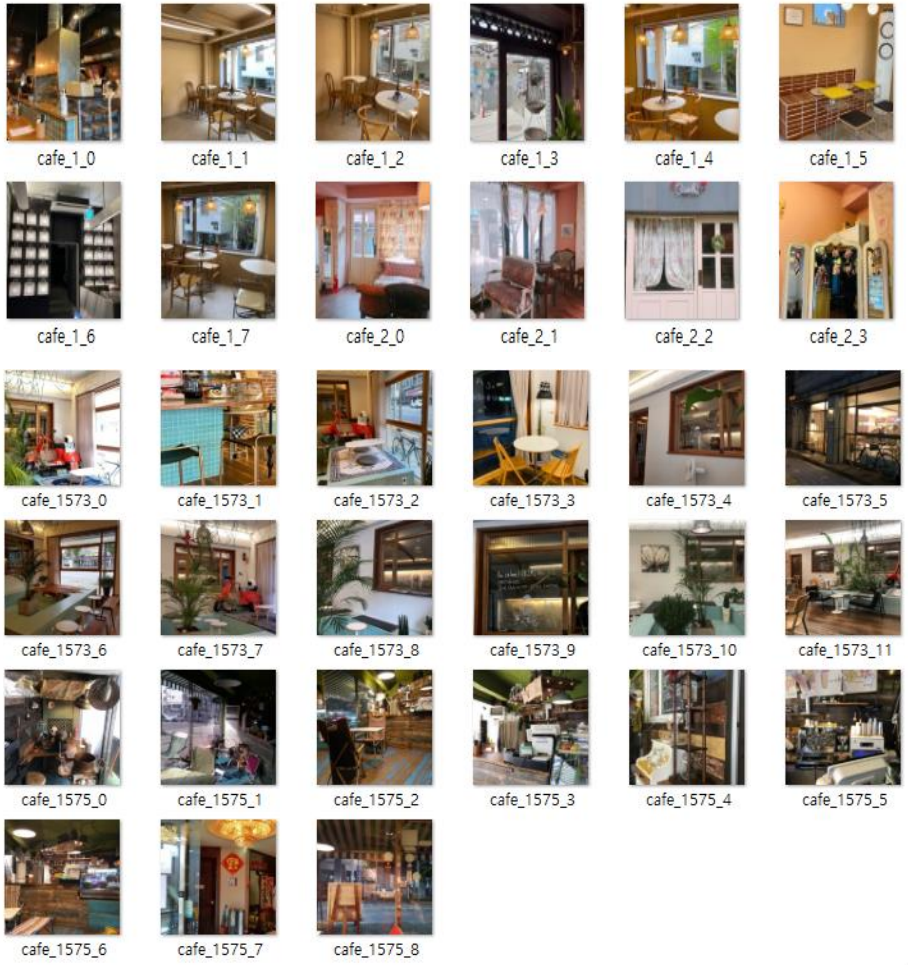
Crawling image inside cafe on 'Naver Map'

Collection range is limited to Seoul.



- https://m.map.naver.com/search2/search.naver?query=%EA%B3%B5%EB%A6%89%EB%8F%99%20%EC%B9%B4%ED%8E%98&sm=hty&style=v5

Data Collection



- Search ' ~ Dong Cafe' on Naver Map.
- 76 cafes per search term, 10 image crawls per cafe.
- Collection area: Mangwon-dong, Yeonnam-dong, Eulji-ro, Gangnam, Gongneung-dong, Jongno, Hannam-dong, Hongdae, Jamsil, Seongsu Station, Itaewon, Anam, Sungshin Women's University, Hyehwa, Apgujeong, Gongdeok Station
- Collect **10143** cafe interior image data

Pretrained model

Pretrained model

1. Resnet50

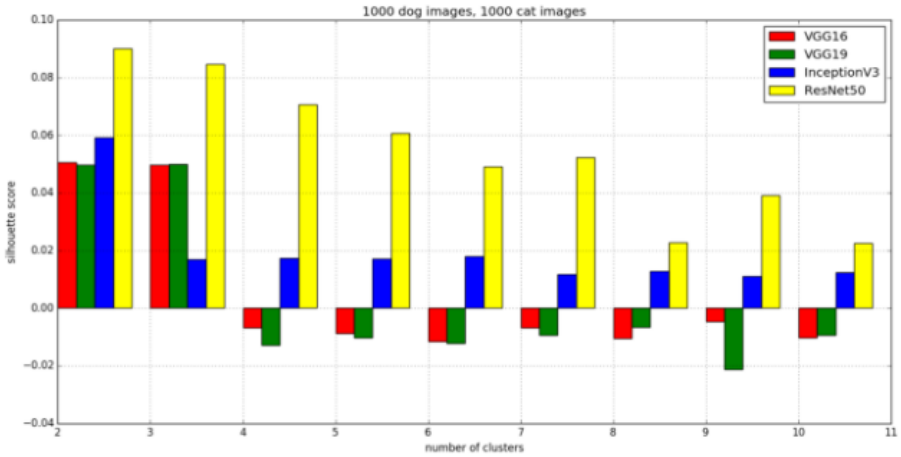
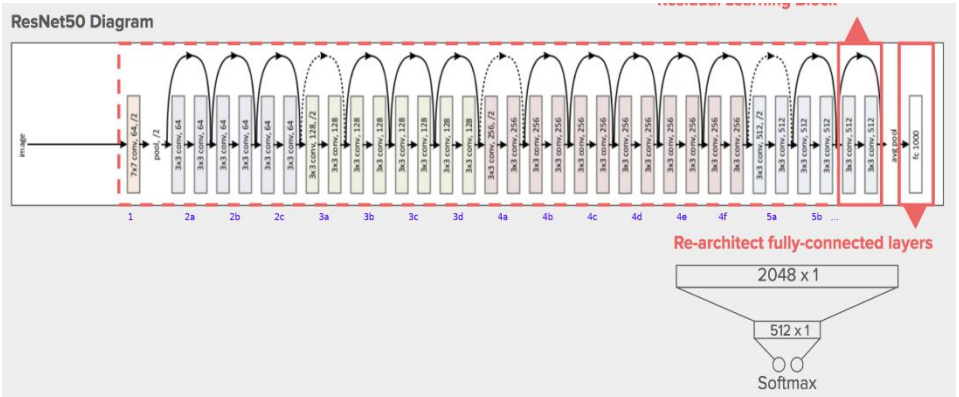


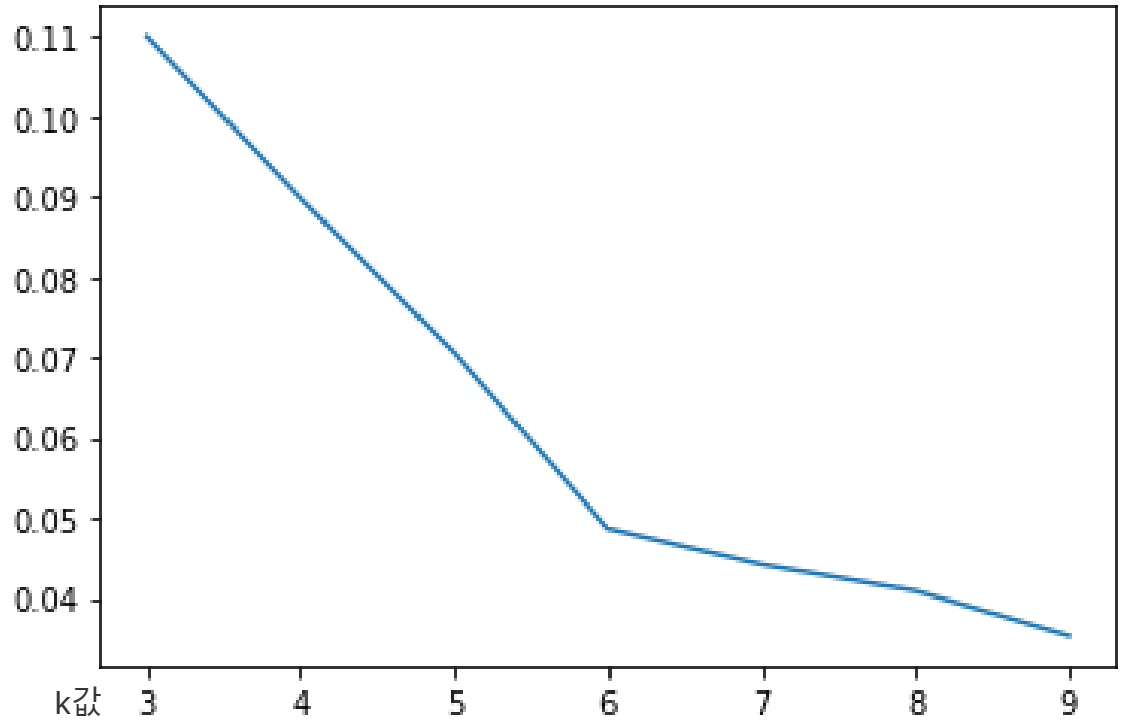
Figure 6. Silhouette Score in Internal Cluster Validation



- Choose the Resnet50 model with the best performance in kmeans clustering among the various pretrained models
- Do not learn additional ResNet50 models
- Take output features for the collected image data and cluster them k-means

Pretrained model

1. Resnet50 – silhouette

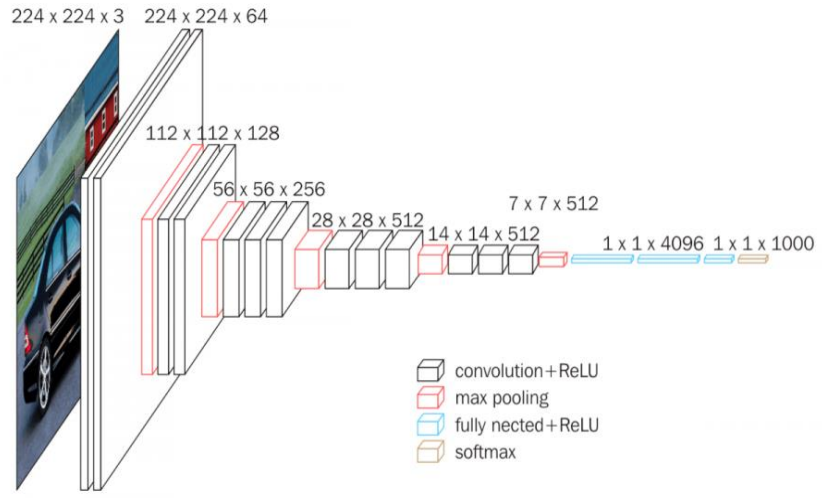


➡ There is no guarantee that the model that learned Imagenet images will extract the features of ineterior cafe images well.

Pretrained model

2. VGG16_PLACES_365

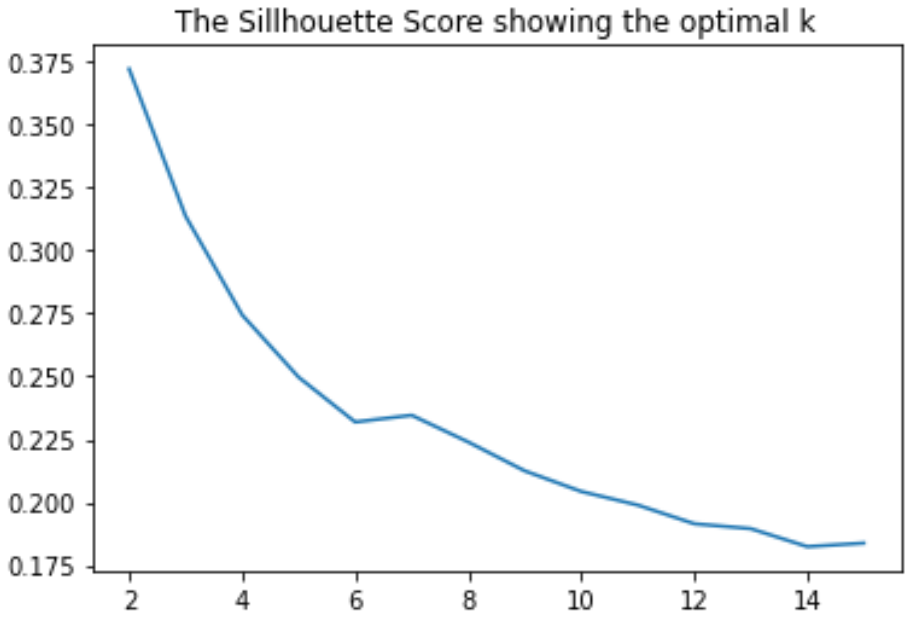
Deep Feature	SUN397	MIT Indoor67	Scene15	SUN Attribute	Caltech101	Caltech256	Action40	Event8	Average
Places365-AlexNet	**56.12**	**70.72**	89.25	92.98	66.40	46.45	46.82	90.63	69.92
Places205-AlexNet	54.32	68.24	**89.87**	**92.71**	65.34	45.30	43.26	94.17	69.15
ImageNet-AlexNet	42.61	56.79	84.05	91.27	**87.73**	**66.95**	**55.00**	**93.71**	72.26
Places365-GoogLeNet	**58.37**	73.30	**91.25**	**92.64**	61.85	44.52	47.52	91.00	70.06
Places205-GoogLeNet	57.00	**75.14**	90.92	92.09	54.41	39.27	45.17	92.75	68.34
ImageNet-GoogLeNet	43.88	59.48	84.95	90.70	**89.96**	**75.20**	**65.39**	**96.13**	75.71
Places365-VGG	**63.24**	76.53	**91.97**	**92.99**	67.63	49.20	52.90	90.96	73.18
Places205-VGG	61.99	**79.76**	91.61	92.07	67.58	49.28	53.33	93.33	73.62
ImageNet-VGG	48.29	64.87	86.28	91.78	**88.42**	**74.96**	**66.63**	**95.17**	77.05
Hybrid1365-VGG	61.74	77.63	92.12	93.75	87.48	75.37	67.91	94.17	**81.27**

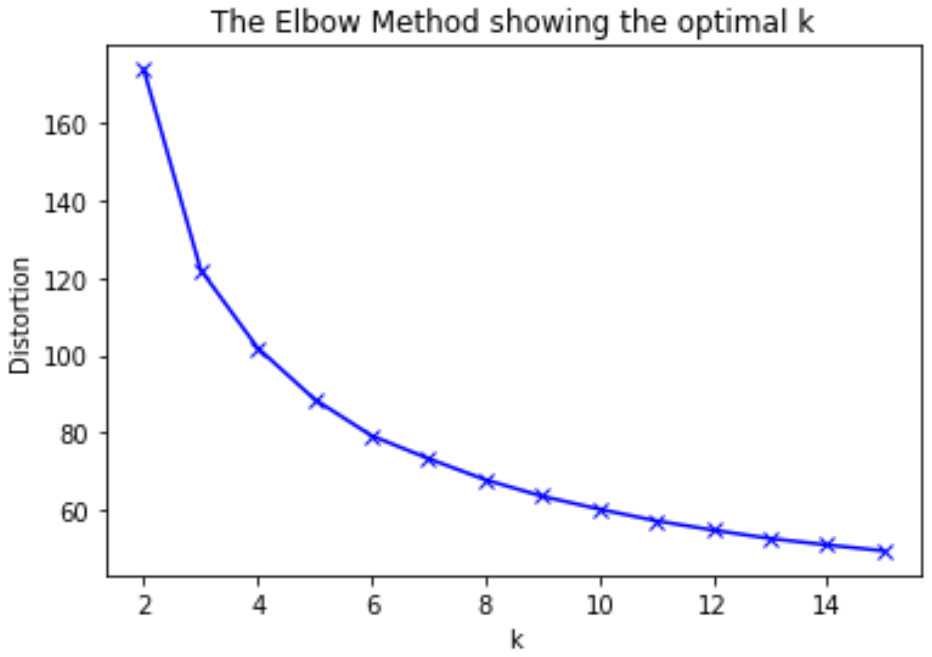


- *Various pre-trained models that have learned Scene images*
- *Place365-VGG model available on github*
- *A model that has learned 1.8 million scene images.*
- *Do not learn additional models VGG16_PLACES_365*
- *Take output values for the collected image data and cluster them k-means*

Pretrained model

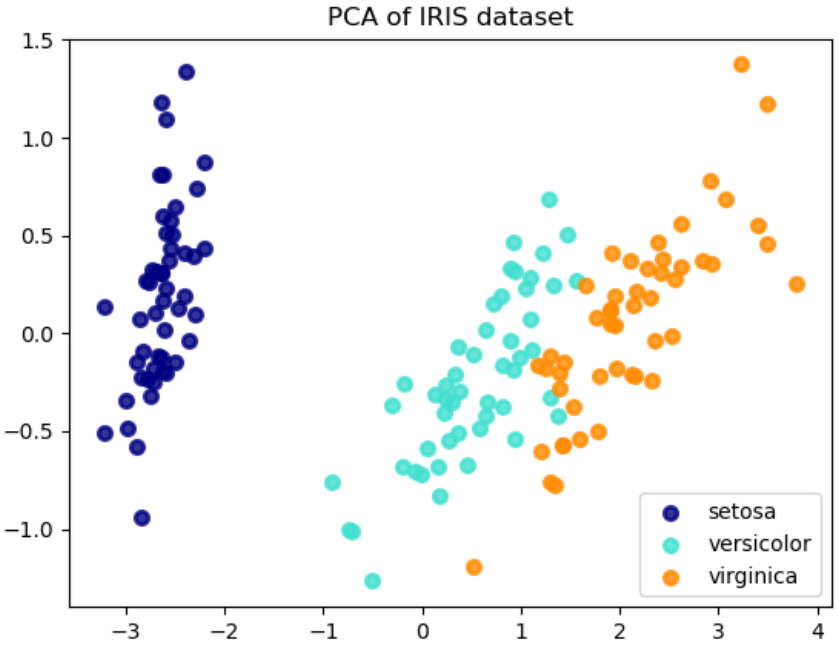
2. VGG16_PLACES_365





Pretrained model

3. VGG16_PLACES_365 + PCA

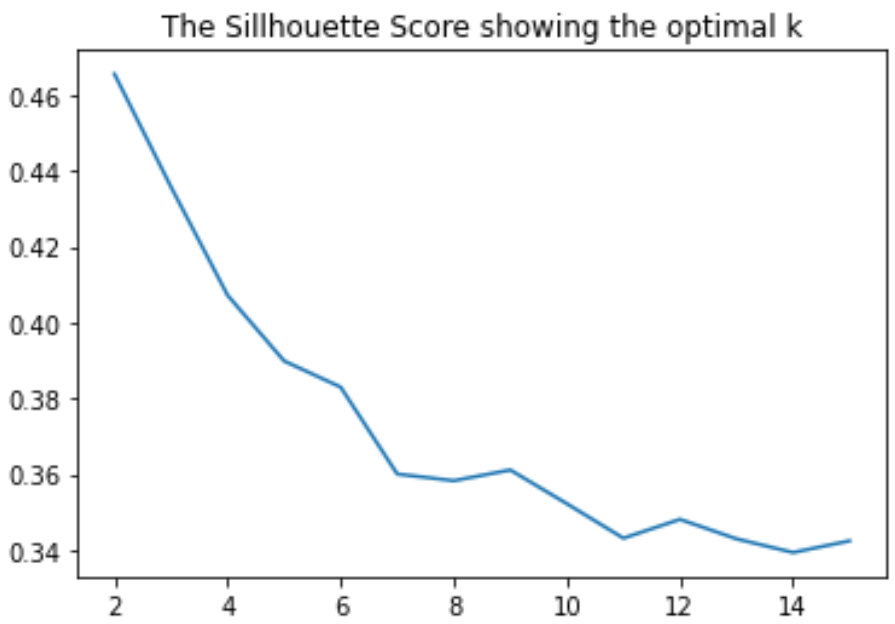


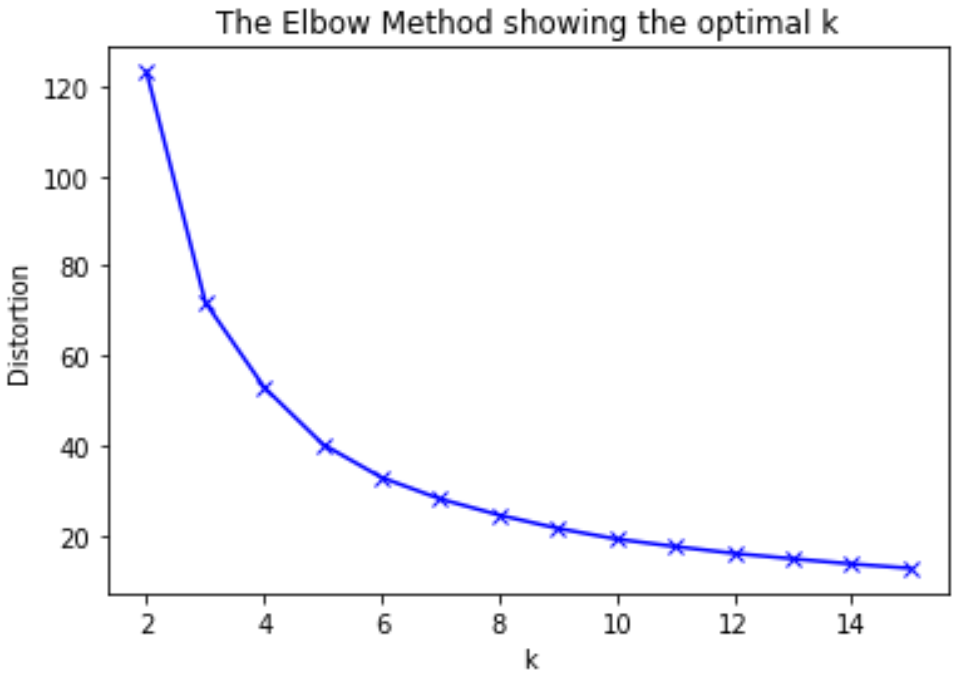
<pca 예시>

- One of the ways to improve the performance of clustering is PCA-dimensional reduction.
- the PCA by using the feature output value for this model
- K means clustering 365 dim > 2dim data

Pretrained model

3. VGG16_PLACES_365 + PCA

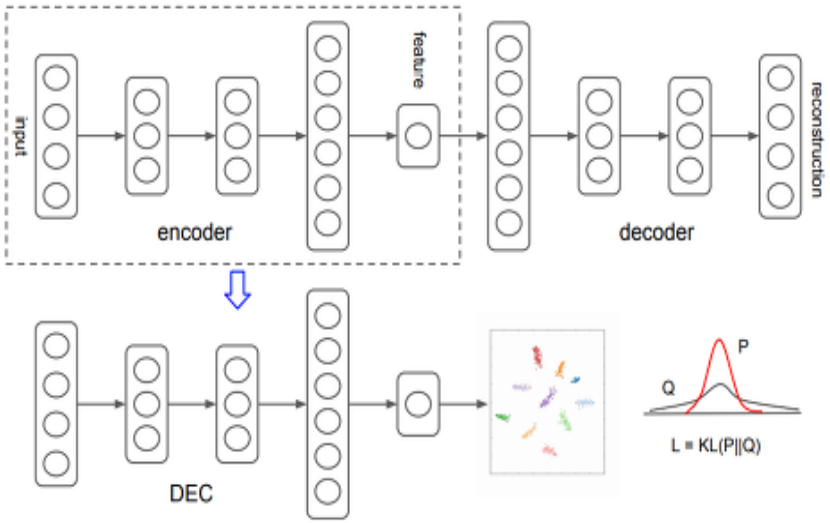




DEC model

DEC model

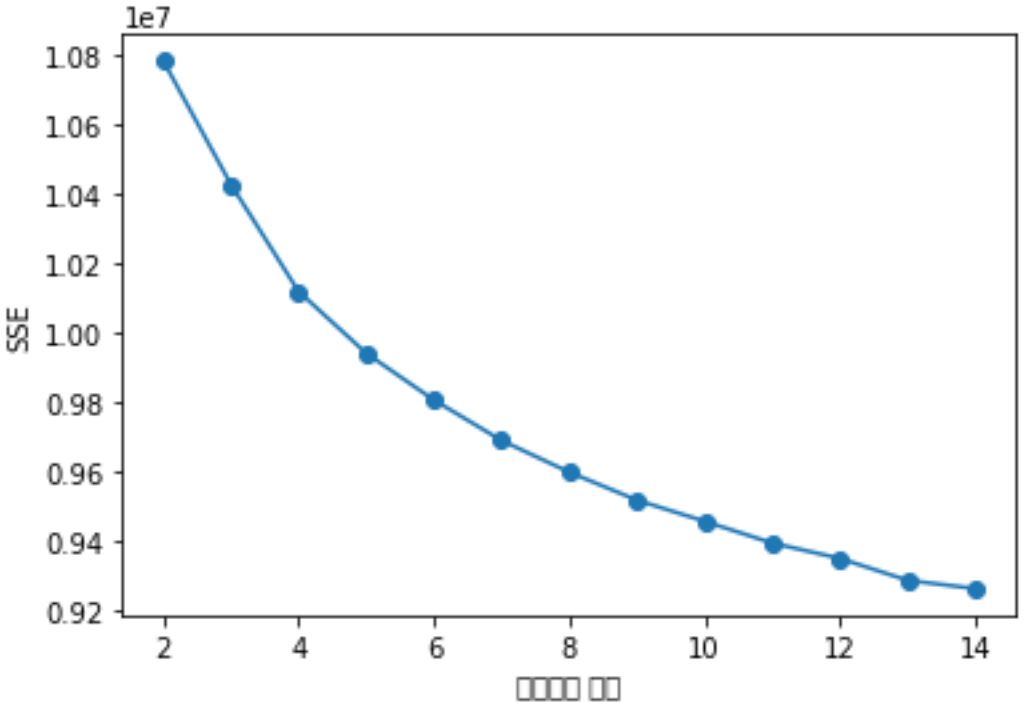
Deep Embedded Clustering Model



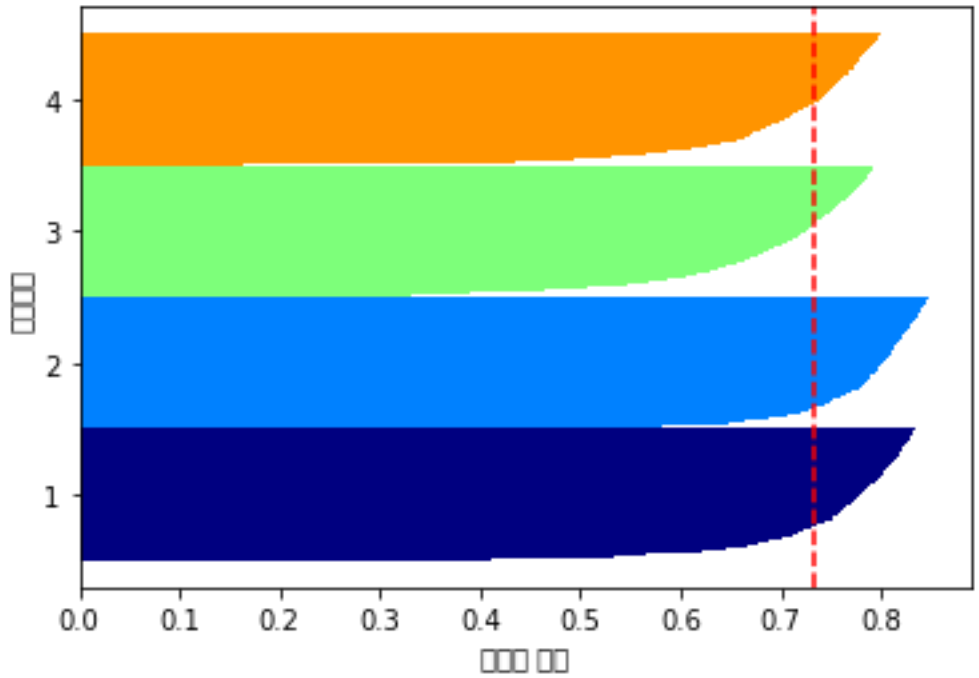
- *To learn feature representations and cluster assignments simultaneously using deep neural networks*
- *Learning mapping from data space to feature space in lower dimensions to optimize clustering objectives iteratively.*
- *It is not a Supervised Learning.*

DEC model

Deep Embedded Clustering Model



- Elbow Method



- Sillhouette Score

Result

Survey

Survey method

딥러닝 결과 설문조사

본 설문조사는 딥러닝 결과 값이 좋은지 나쁜지 확인하는 설문조사

응답기간 : 2021.06.12(토) - 2021.06.13(일)

1. 성별을 선택해주세요.

○ 남성
○ 여성

2-1. 다음 카페 사진들이 분위기나 느낌이 비슷한지 선택해주세요

사진들의 느낌이 비슷한 정도에 따라 점수를 선택해주세요.

- *Whether the clustering learned by the model actually fits out purpose is a different problem from the performance.*
- *To verify this, we conducted a survey.*
- *Distinguished because men and women have different standards of selecting café.*
- *Cluster-specific, cluster-specific pictures are randomly selected to investigate. (Prevent the same cafe from entering a group.)*
- *Survey form : http://naver.me/5wf1uY1e*

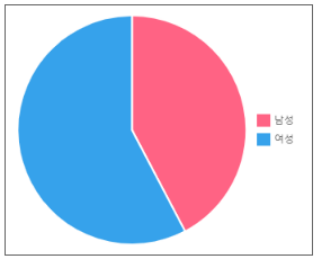
Survey

Survey Result

52명 응답 응답 별 결과보기 >

요약

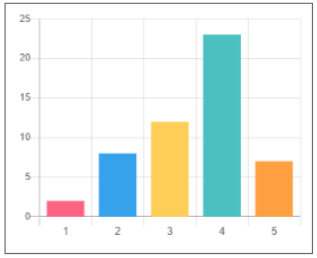
1. 성별을 선택해주세요.



숨기기 취소 | 정렬 초기화 | 조합 | 차트 편집

응답	응답수	
남성	22	42.3%
여성	30	57.7%

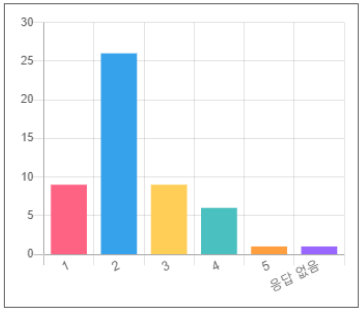
2-1. 다음 카페 사진들이 분위기나 느낌이 비슷한지 선택해주세요



숨기기 취소 | 정렬 초기화 | 조합 | 차트 편집

응답	응답수	
1	2	3.8%
2	8	15.4%
3	12	23.1%
4	23	44.2%
5	7	13.5%

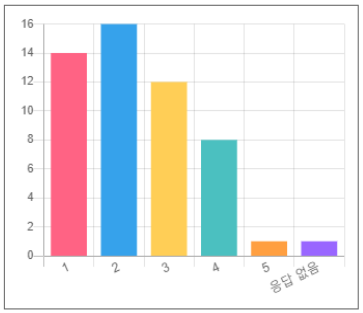
6-1. 다음 카페 사진들이 분위기나 느낌이 비슷한지 선택해주세요



숨기기 취소 | 정렬 초기화 | 조합 | 차트 편집

응답	응답수	
1	9	17.3%
2	26	50%
3	9	17.3%
4	6	11.5%
5	1	1.9%
응답 없음	1	1.9%

6-2. 다음 카페 사진들이 분위기나 느낌이 비슷한지 선택해주세요



숨기기 취소 | 정렬 초기화 | 조합 | 차트 편집

응답	응답수	
1	14	26.9%
2	16	30.8%
3	12	23.1%
4	8	15.4%
5	1	1.9%
응답 없음	1	1.9%

Survey

Survey Result

	men	women	all
cluster 1	3.65	3.43	3.52
cluster 2	3.11	3.22	3.18
cluster 3	3.61	3.45	3.51
cluster 4	2.65	2.52	2.58
each cluster	2.36	2.28	2.31

Q & A

Thank you

참고문헌

Selection of Restnet50
https://franky07724-57962.medium.com/using-keras-pre-trained-models-for-feature-extraction-in-image-clustering-a142c6cdf5b1

Compare to various pretrained model trained Scene image
https://github.com/AMANVerma28/Indoor-Outdoor-scene-classification

place365-vgg
https://github.com/AMANVerma28/Indoor-Outdoor-scene-classification

Resne50 architecture
https://stackoverflow.com/questions/54207410/how-to-split-resnet50-model-from-top-as-well-as-from-bottom

VGG16_PLACES_365 arhitecture
https://bskyvision.com/504

Dec model
https://arxiv.org/pdf/1511.06335.pdf