Davide Montagno Bozzone (535910)

Assignment 2 – Image understanding with LDA and and the bag of visual terms

Code Snippets

1. Get all descriptors and keypoint

```python
def create_descriptors(path):
    for each_element in path:
        img_colored=io.imread("./data/"+each_element["name"])
        img_gray = cv2.cvtColor(img_colored, cv2.COLOR_BGR2GRAY)
        sift=cv2.xfeatures2d.SIFT_create()
        mser = cv2.MSER_create()
        keypoints = mser.detect(img_colored)
        keypoints,descriptor=sift.compute(img_colored, keypoints)
        each_element["keypoints"]=keypoints
        each_element["descriptor"]=descriptor
create_descriptors(training_set)
create_descriptors(test_set)
```

2. Create dictionary

```python
n_cluster=500
descriptors = training_set[0]["descriptor"]
for each_element in training_set[1:]:
    descriptors = np.vstack((descriptors, each_element["descriptor"]))
codebook, distortion  = vq.kmeans(vq.whiten(descriptors), n_cluster)
```

3. Get all BoVW

```python
def create_BoVW(path):
    for each_element in path:
        code, dist = vq.vq(vq.whiten(each_element["descriptor"]), codebook)
        each_element["code"]=code
        BoVW, _ = np.histogram(each_element["code"], bins=range(codebook.shape[0]))
        word_freq=[(i,freq) for i, freq in enumerate(BoVW)]
        each_element["hist"]=word_freq
create_BoVW(training_set)
create_BoVW(test_set)
```

4. Make predictions

```python
def prediction(alpha,n_topic):
    all_histograms=[each_elem["hist"] for each_elem in training_set]
    lda = LdaModel(all_histograms, alpha=alpha,  num_topics=n_topic,  per_word_topics=True ,minimum_probability=0 )
    for each_elem in test_set:
        doc_topics, word_topics, phi_values = lda.get_document_topics(each_elem["hist"], per_word_topics=True,
minimum_probability=0)
        img=io.imread("./data/"+each_elem["name"])
        for i, kp in enumerate(each_elem["keypoints"]):
            img_copy=img.copy()
            cod=each_elem["code"][i]
            color=[item[1][0] for item in word_topics if item[0] == cod]
            img=cv2.drawKeypoints(img_copy, [kp], img, color=dict_color[color[0]])
```
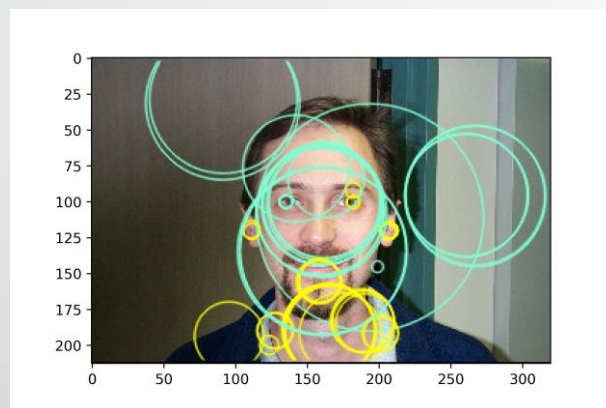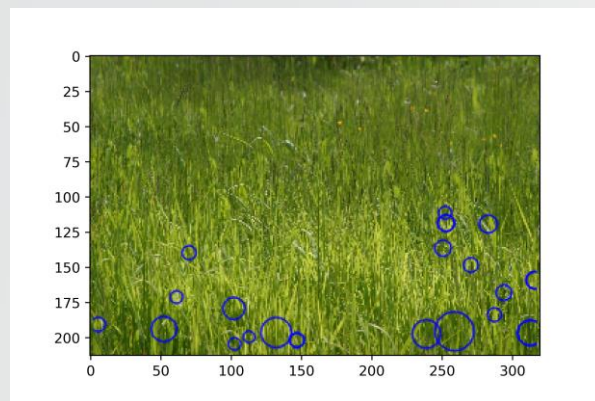
Model selection
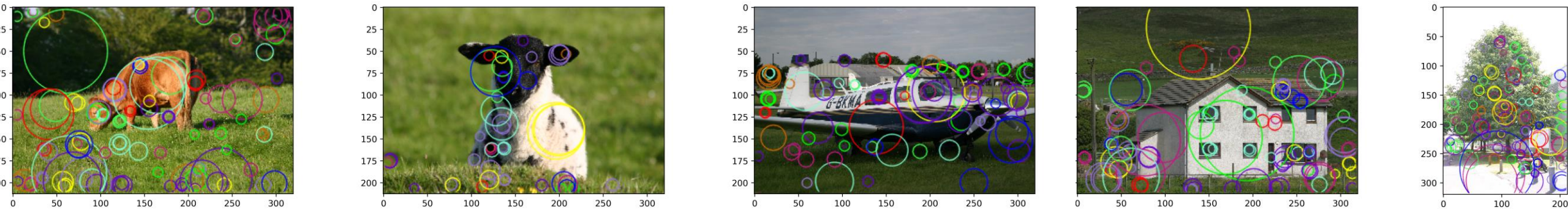
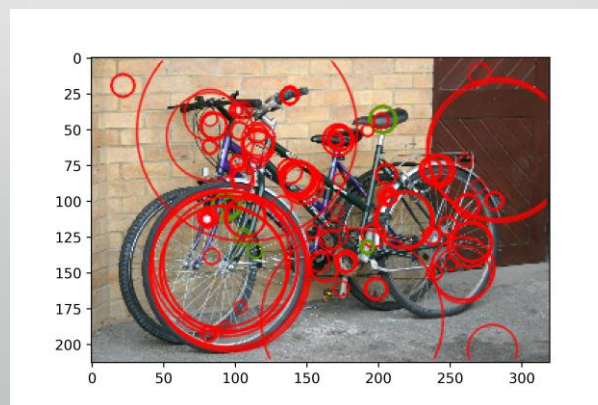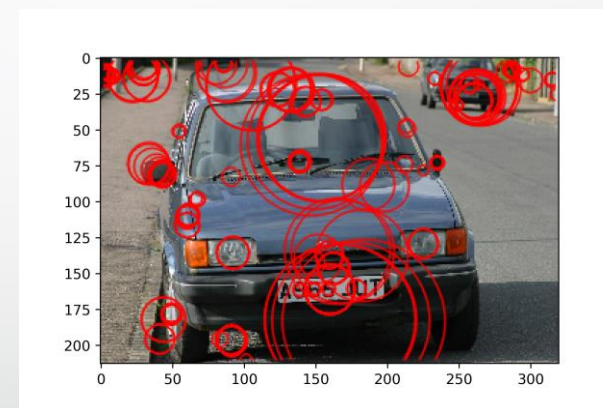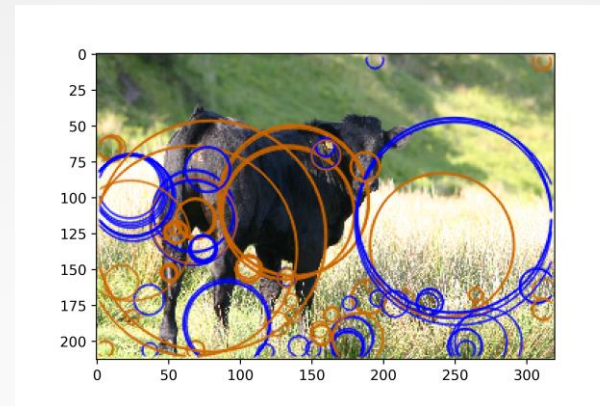Alpha: 1 – Topic: 12
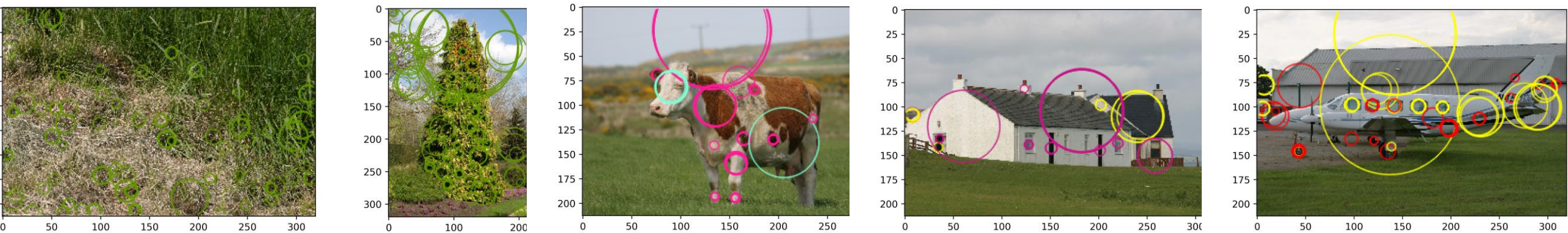
Alpha: 0.09 – Topic: 12

Best Results

Alpha: 0.05 - Topic: 12

Personal Considerations

- Model instability
  - Dataset small and images pattern similar
  - Cluster equals 500 too much high
- Evalution model
  - Calculate model coherence
  - No result for evaluation due to high variance in test results
- *Sklearn* library not sufficient with this project