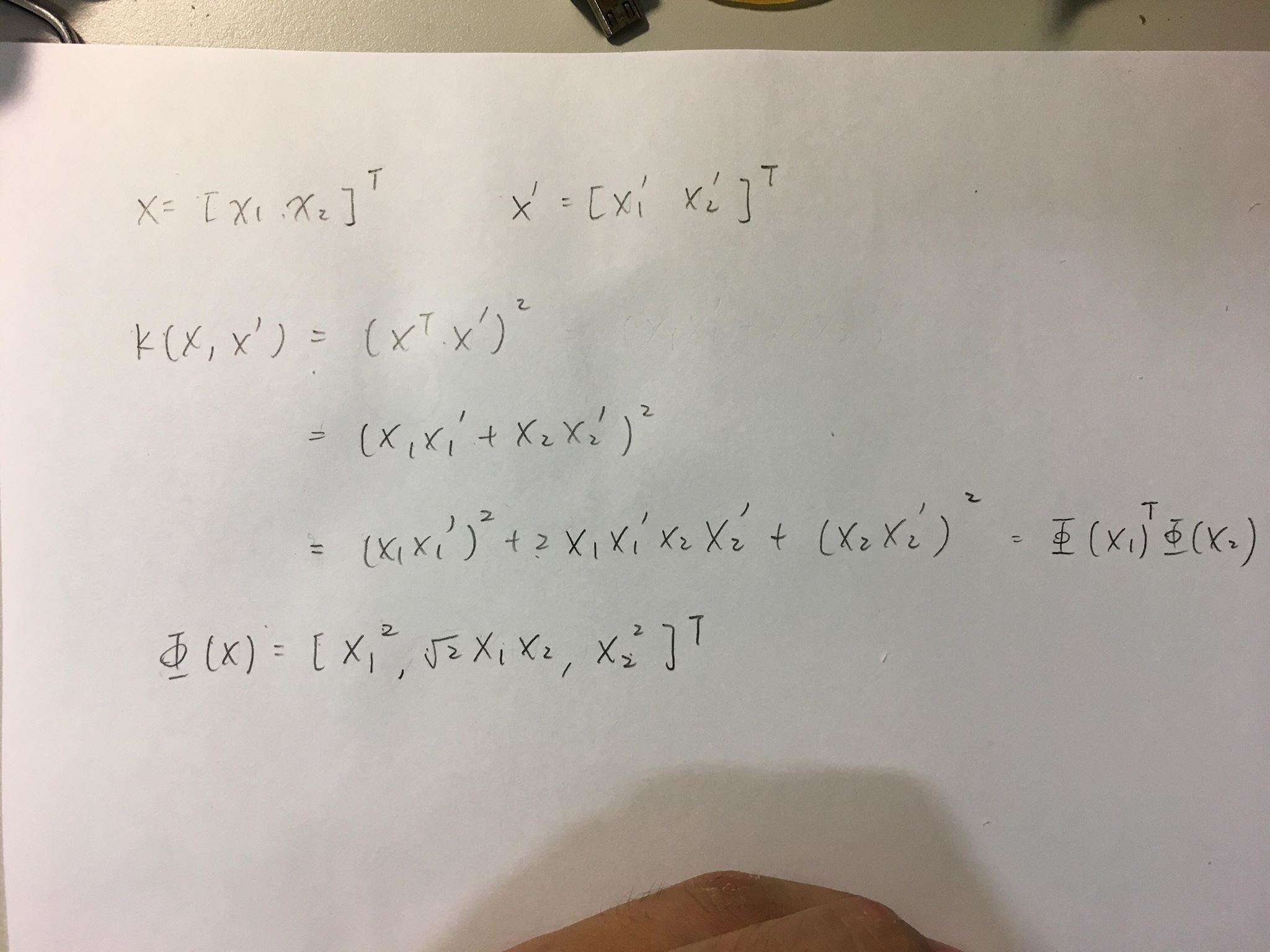
**R05942102 王冠驊**

**DLCV HW2**

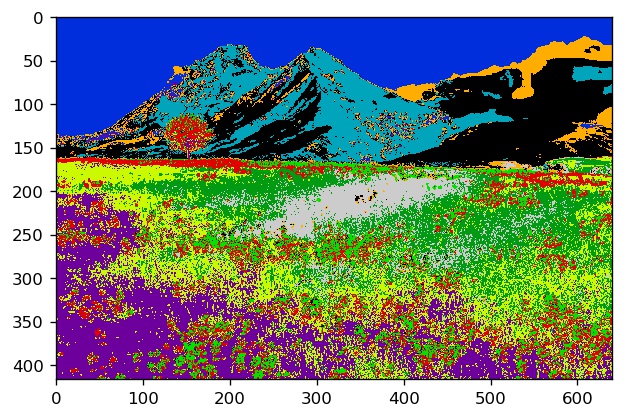
**Problem 1: Kernel Trick (10%)**

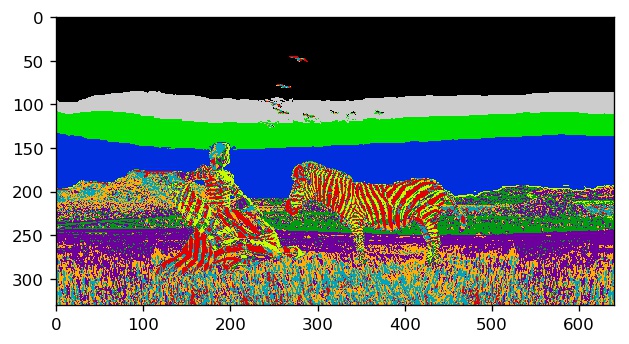


**Problem 2 : Color and Texture Segmentation (40%)**

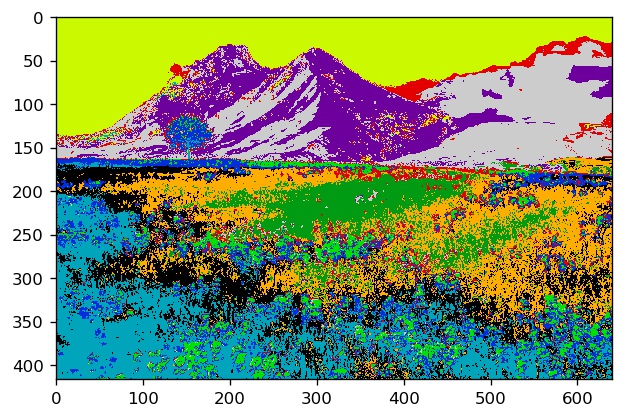
(a) (20%) Color segmentation:

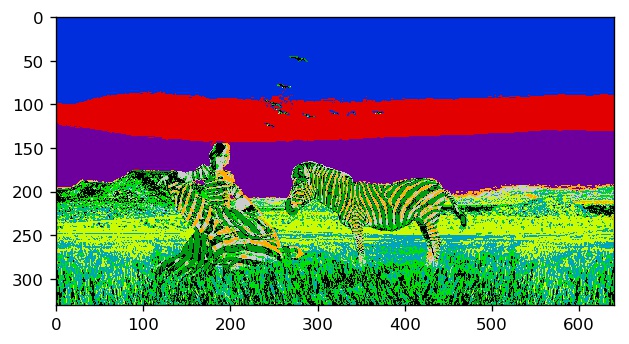
(i) Plot the segmentation results for both images based on your clustering results.





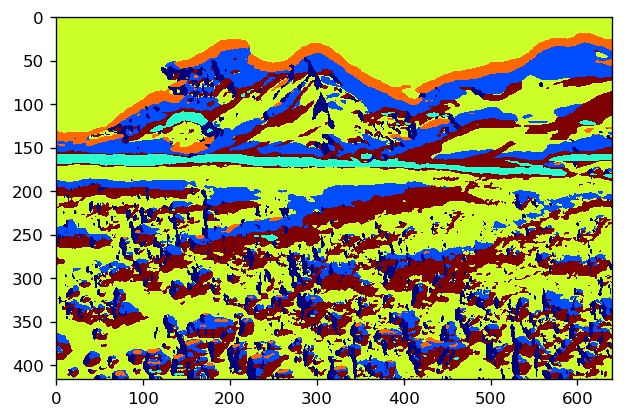
(ii) Convert both RGB images into Lab color space.

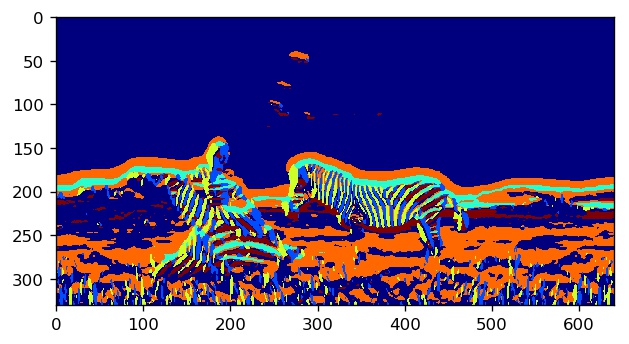




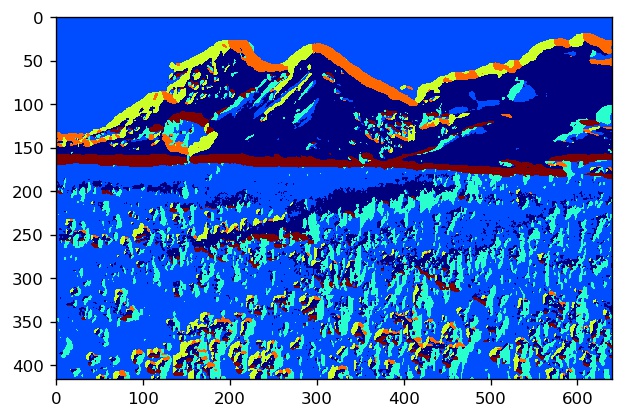
(b) (20%) Texture segmentation:

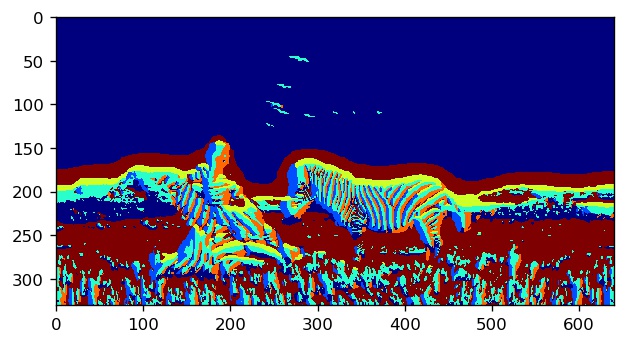
(i) Please plot the texture segmentation results for both images,





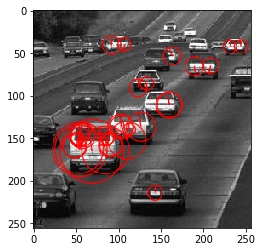
(ii) Combine both color and texture features for image segmentation.

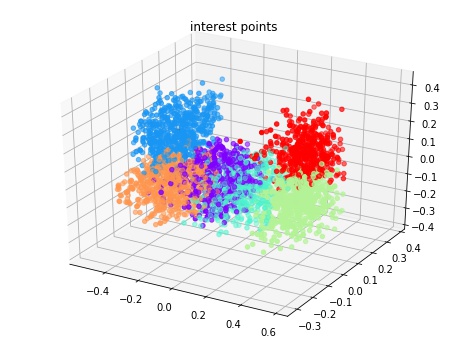
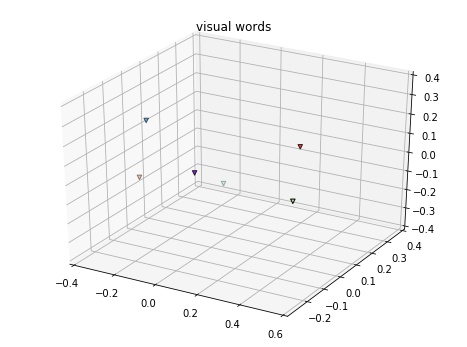


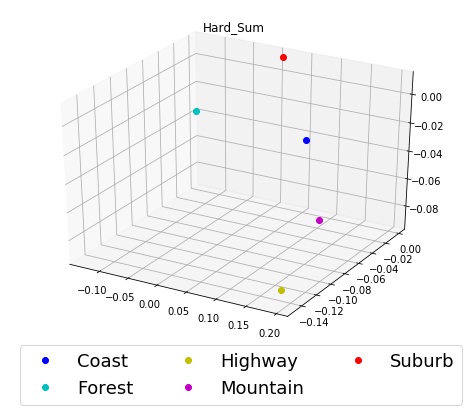
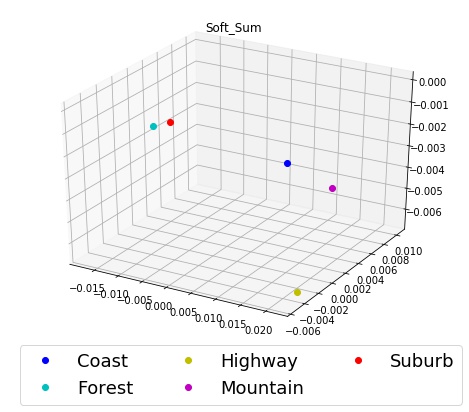


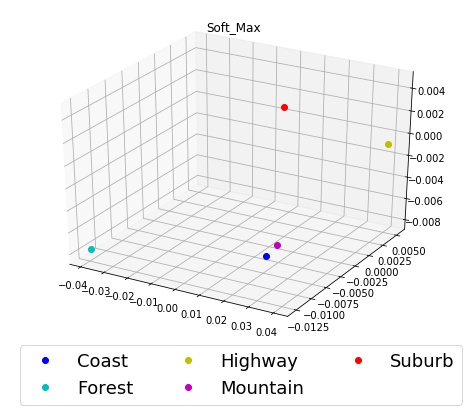
**Problem 3 : Recognition with Bag of Visual Words (60%)**

(a) (5%) Detect interest points and calculate their descriptors for this image using SURF.



(b) (10%) Plot the visual words and the associated interest points in this PCA subspace.

(c) (20%) Choose one image from each category and plot their Hard-Sum, Soft-Sum, and Soft-Max, respectively.



Can you expect which BoW strategy results in better classification results and why?

從此小題的視覺化結果，我們觀察到使用Hard-Sum時可以使5類的圖片的樣本點分的最開。而當使用Soft-Sum以及Soft-Max時則無法完全分開所有不同種類的圖片。故根據此小題的結果，我們推測使用Hard-Sum 應該會得到最好的分類效果。

(d) (25%)

(i) Use Train-10 as the training data and Test-100 for testing. Report the classification accuracy using Hard-Sum, Soft-Sum, and Soft-Max.

在此小題的實驗中，我們測是不同的參數 c=[50, 100, 200], k=[1, 3, 5, 7, 9]。以下我們列出分別使用Hard-Sum, Soft-Sum 與 Soft-Max 所得到的最好的分類結果以及個別的c與k的值:

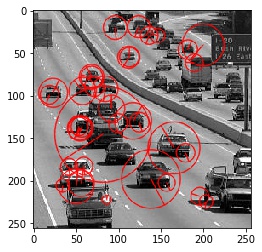
|  |  |  |  |
| --- | --- | --- | --- |
|  | accuracy | c | k |
| Hard-Sum | **63.4%** | 100 | 5 |
| Soft-Sum | 55.4% | 200 | 1 |
| Soft-Max | 59.2% | 200 | 5 |

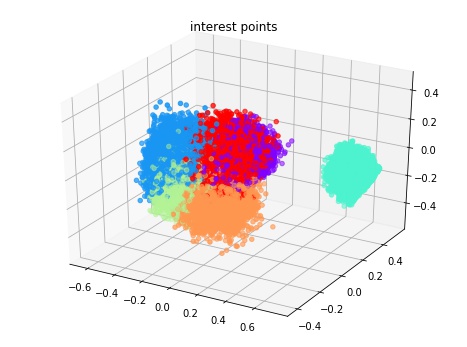
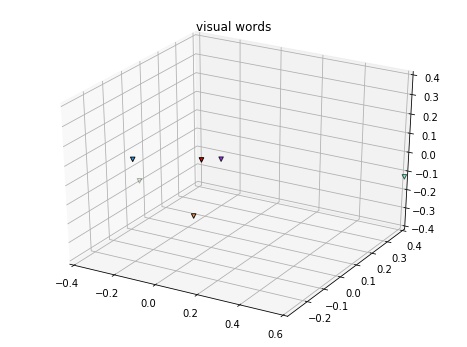
Are the results as expected (based on your observation on different BoW features in (c))? If not, why?

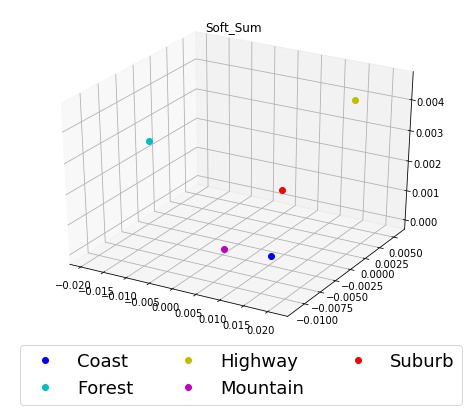
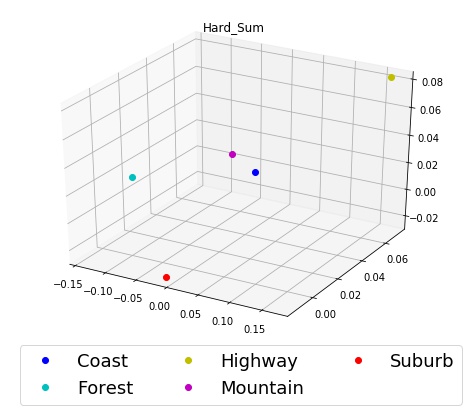
這樣的結果與預期的結果相同。(c)小題中，使用Hard-Sum可以使不同類的圖片分的最開，在這裡我們也可以看到使用Hard-Sum可以得到最高的分類準確率。

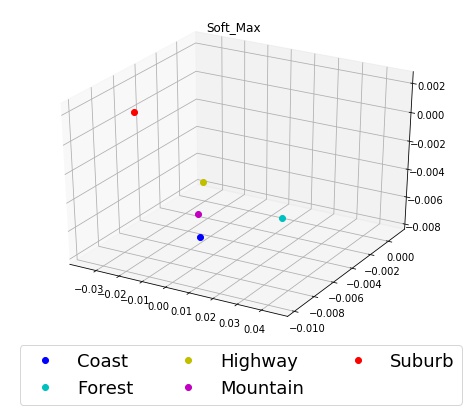
(ii) Repeat (a) to (c) using Train-100 as the training data.

(a)



(b)

(c)



在Train-100當做training data 可以發現使用Soft-Sum時不同種類的圖片彼此會分的最開，故我們推測使用Soft-Sum時會有最好的分類效果。

(d)

在此小題的實驗中，我們測是不同的參數 c=[50, 100, 200], k=[1, 3, 5, 7, 9, 11, 13, 15, 17, 19]。以下我們列出分別使用Hard-Sum, Soft-Sum 與 Soft-Max 所得到的最好的分類結果以及個別的c與k的值:

|  |  |  |  |
| --- | --- | --- | --- |
|  | accuracy | c | k |
| Hard-Sum | 72.4% | 50 | 7 |
| Soft-Sum | **72.8%** | 200 | 7 |
| Soft-Max | 70.8% | 200 | 5 |

Do you observe improved classification results? Please report and explain your results.

隨著training data的增加，分的準確率也有顯著的提升。其中參數k也有變大的趨勢，代表我們可以參考更多相近的圖片的標籤提升分類的準確率。此外，最佳的分類準確率發生在我們使用Soft-Sum，此結果也與我們使用Train-10當做training data時不同。