

1 K-Means

1.1 Objective Function

Required chart present in Figure 1.

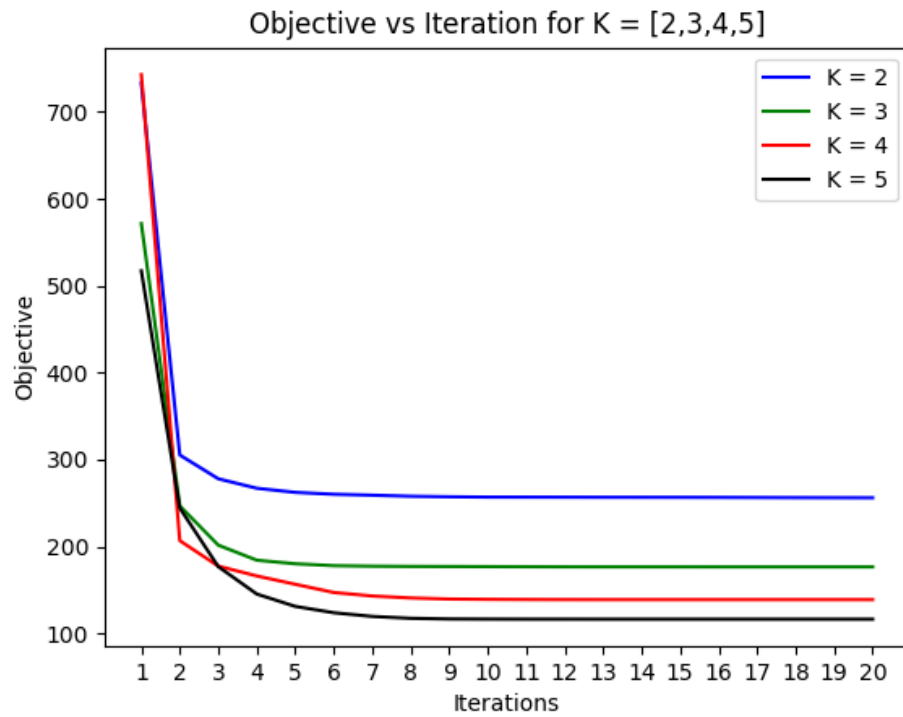


Figure 1: Objective Change per Iteration for 10 runs

1.2 Final clusters

The clusters are marked by different colors in the charts.

For $K=3$, the clusters are shown in Figure 2

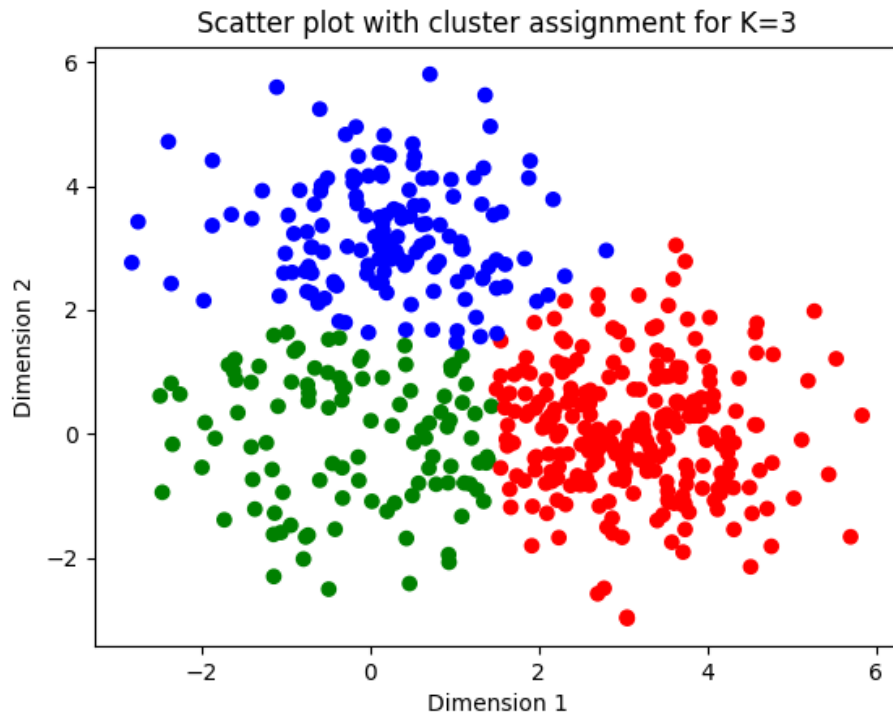


Figure 2: Cluster assignment for $K=3$

For $K=5$, the clusters are shown in Figure 3

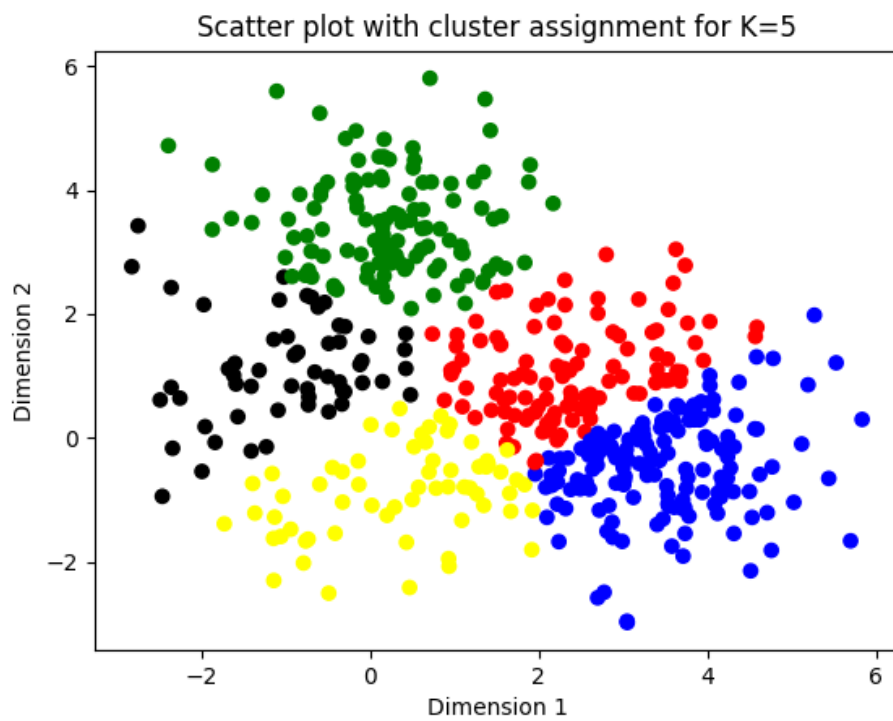


Figure 3: Cluster assignment for K=5

2 Matrix Factorization

2.1 Training Objective

The objective variation per iterations for 10 runs is shown in Figure 4

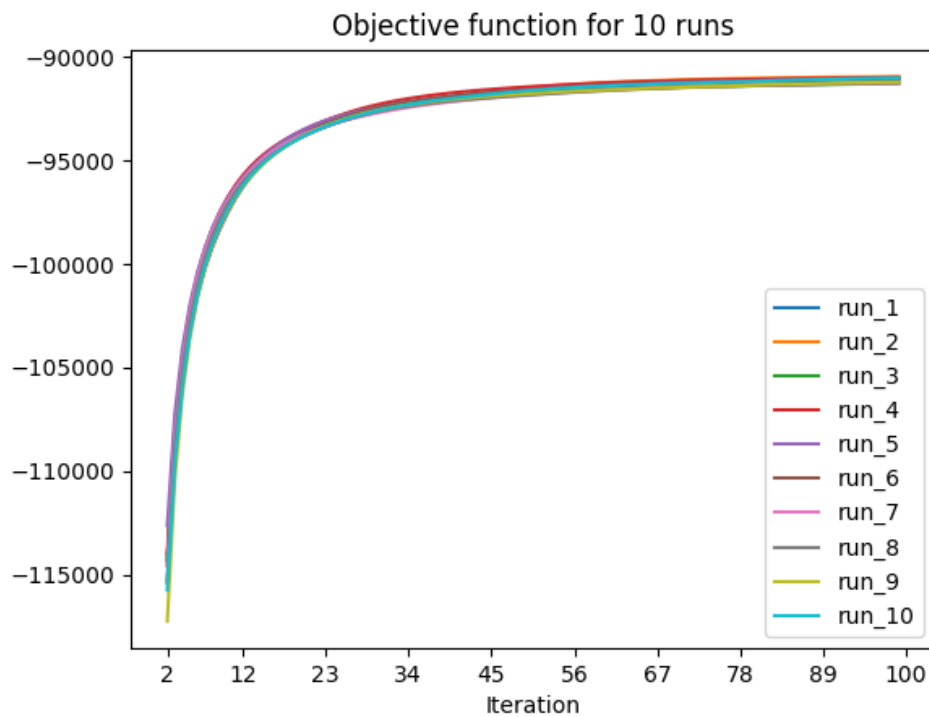


Figure 4: Objective variation per iteration for 10 runs

The objective function and test RMSE for the 10 runs is shown in Figure 5

rank	objective	test_rmse
1	-90948.2	1.114
2	-90984.4	1.110
3	-91018.2	1.108
4	-91030.9	1.135
5	-91036.1	1.128
6	-91082.9	1.133
7	-91211.9	1.102
8	-91236.8	1.098
9	-91266.1	1.159
10	-91280.0	1.135

Figure 5: Objective and Test RMSE for 10 runs

2.2 Query Results

The 10 closest movies for each movie, in the increasing order to distance, are shown in Figure 6

Star Wars	My Fair Lady	GoodFellas
Empire Strikes Back, The (1980)	Mary Poppins (1964)	Full Metal Jacket (1987)
Raiders of the Lost Ark (1981)	American in Paris, An (1951)	Casino (1995)
Return of the Jedi (1983)	My Family (1995)	Short Cuts (1993)
Wrong Trousers, The (1993)	Sound of Music, The (1965)	Good, The Bad and The Ugly, The (1966)
Manon of the Spring (Manon des sources) (1986)	Sabrina (1954)	Alien (1979)
My Man Godfrey (1936)	Snow White and the Seven Dwarfs (1937)	Cool Hand Luke (1967)
Indiana Jones and the Last Crusade (1989)	Return of Martin Guerre, The (Retour de Martin Guerre, Le) (1982)	People vs. Larry Flynt, The (1996)
Toy Story (1995)	Wizard of Oz, The (1939)	Raising Arizona (1987)
Usual Suspects, The (1995)	Singin' in the Rain (1952)	Apocalypse Now (1979)
Grand Day Out, A (1992)	Cinderella (1950)	Godfather: Part II, The (1974)

Figure 6: Nearest Movies for each Query Movie

The distances of closest movies for each movie, corresponding to Figure 6, are shown in Figure 7

Star Wars	My Fair Lady	GoodFellas
0.32909	0.55519	0.55900
0.57097	0.61588	0.62063
0.61814	0.64261	0.68448
0.73918	0.66212	0.71045
0.76497	0.78286	0.76139
0.80003	0.82167	0.80806
0.82801	0.86014	0.85997
0.84557	0.86345	0.86259
0.94126	0.87729	0.87832
0.95923	0.89072	0.87957

Figure 7: Nearest Movie Distances for each Query Movie