

1. Introduction

The project goal from the assigned details was to find the most suitable number of groupings. This is thus needed for customer segmentation for our telecommunications firm that enhances the various clustering analysis techniques.

Data Used: We have used the provided dataset that had various kinds of customer records like annual spending, service tenure, contract type, and device ownership to identify natural groupings and many more.

Methods Applied: We applied the elbow method to determine the optimal number of clusters.

2. Data Preparation

Data Cleaning: Null values were eliminated using techniques like mean imputation and the ones that outliers above the 97th percentile was minorized for each variable.

Feature Selection: After this analysis process, the seven key indicators were also selected that caught the customers' value, commitment, and technology adoption like monthly charges, years as a client, and number of connected devices, etc.

Scaling: Feature values were marginalised using the procedure called Standard Scaler. This helped to get all attributes on desirables scales for model training process.

3. Methods for Determining Optimal Clusters

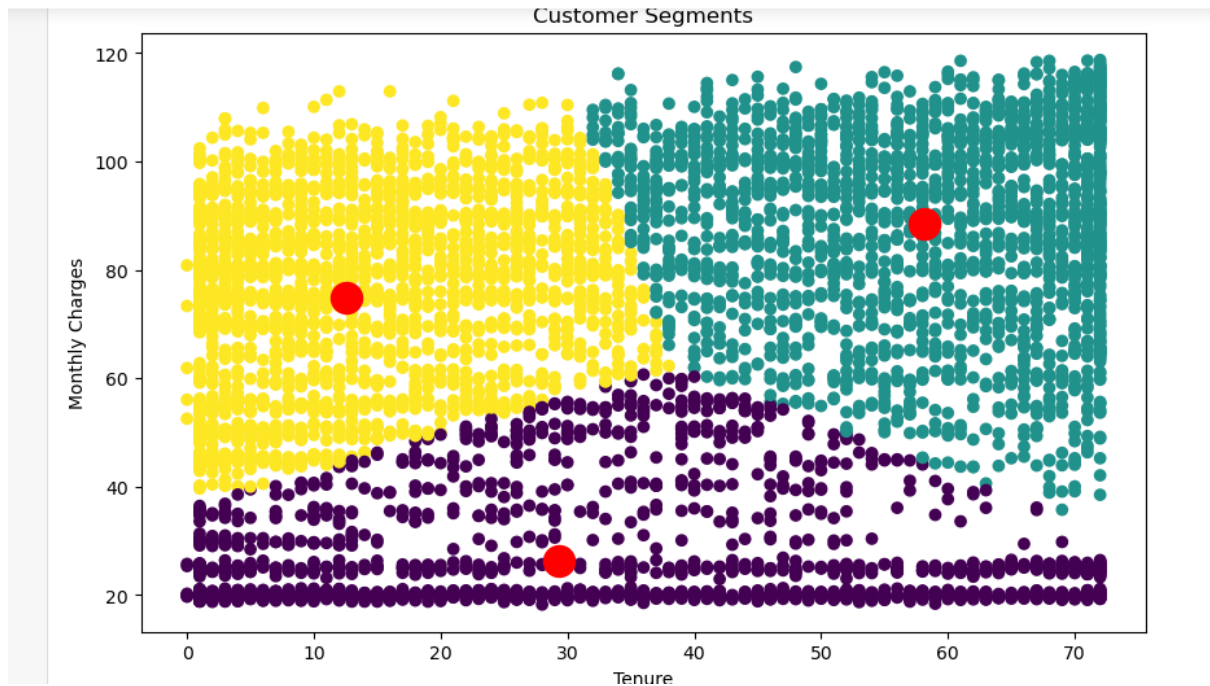
3.1. Elbow Method:

The elbow method, a very popular technique is here used in finding out total the number of clusters through this clustering analysis process. This illustrates that in doing so, a graph is needed to be plotted with the number of clusters on x, and variance explained by PCA as Y as respectively. The elbow technique hence creates the desired variance ratio versus the number of clusters and locates the "elbow". We then determined various cluster solutions to find out the required inflection point.

Implementation: K-means clustering was run for these solutions orientated data's that ranged from 2 to 15 clusters and the total within-cluster sum of squares plotted.

4. Visualization

The plot show below depicts a scatterplot customer distribution of tenure vs monthly charges, with cluster centres indicated for easy understanding.



5. Conclusion

Hence on considered the elbow technique pointing to five to six clusters were so as generated and we decided to take six groupings. The elbow method was identified to have six clusters as a natural structure within the dataset. They do balance the severe complexity and accuracy. The six segments can now be profiled to guide targeted marketing, tailor service bundles ultimately boosting customer relationships.