The Use of Cluster Analysis to Explore Associations in Population Ageing in the Czech Republic

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Introduction

In the last period, lifetime prolongation has become a significant achievement of European societies. On the other hand, population ageing is a major challenge for economies and welfare systems of the member states. This demographic transformation is one of the most important challenges that Europe will face in the future. Higher life expectancy, lower fertility rates, improvement in health and lower mortality rates have consequences on changes in population structure.

The aim of this study is to analyze the selected indicators of population ageing in the Czech Republic using cluster analysis.

Methodology

Research was conducted on the Ageing index in the regions of the Czech Republic, age dependency ratio and life expectancy, but research was focused on the Ageing index. The ageing index is the ratio of the number of elderly persons (aged 65 and over) to the number of children aged 0-14. In this study data received from the Czech Statistical office in the period 2007-2012 were used.

Clustering was performed using two algorithms: fuzzy c-means algorithm and c-means algorithm. To determine the best number of clusters Silhouette value was used (for c-means clustering) and values of the objective function during iterations (for fuzzy c-means clustering).

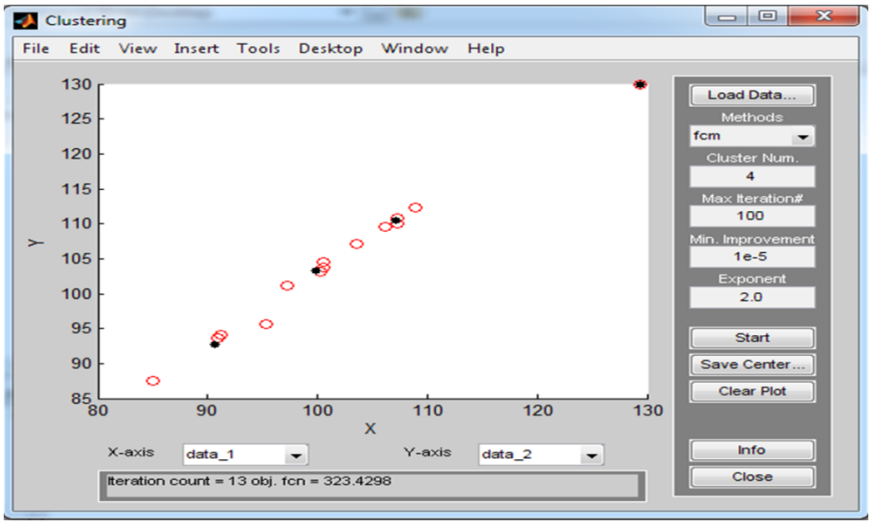
Results

The “best” number of clusters was selected only by mathematical measures of validity the results of the analysis: for fuzzy c-means algorithm it was 4 clusters (the values of the objective function during iterations = 323,4), for c-means algorithm it was 3 (Silhouette value = 230,6).

Figure 1: Results of the clustering

c - means clustering		Fuzzy c - means clustering	
Name of the region	Ageing index	Name of the region	Ageing index
Prague	129,2	Prague	129,2
Central Bohemian Region	95,7	Central Bohemian Region	95,7
South Bohemian Region	106,5	South Bohemian Region	106,5
Plzeň Region	113,2	Plzeň Region	113,2
Karlovy Vary Region	98,5	Karlovy Vary Region	98,5
Ústí nad Labem Region	91,8	Ústí nad Labem Region	91,8
Liberec Region	97,4	Liberec Region	97,4
Hradec Králové Region	113,0	Hradec Králové Region	113,0
Pardubice Region	106,8	Pardubice Region	106,8
Vysočina Region	108,5	Vysočina Region	108,5
South Moravian Region	114,1	South Moravian Region	114,1
Olomouc Region	110,0	Olomouc Region	110,0
Zlín Region	114,4	Zlín Region	114,4
Moravian-Silesian Region	104,9	Moravian-Silesian Region	104,9

Figure 2: Results of fuzzy c-means clustering



Conclusion

In this paper results of the clustering of the ageing index were compared: using the fuzzy c-means clustering and the c-means clustering. Outcomes obtained by fuzzy clustering have been more accurate in comparison with hard clustering.

From the received results it is visible that the capital city of the Czech Republic – Prague is the region with the largest proportion of older people (129,2 people aged 65 and over to 100 children aged 0-14). The ageing index is generally increasing in time in all Czech regions and worldwide as well. Europe is facing the question of population ageing and its social, economic and health problems. From the results of the population projection for the Czech Republic we expect an increase of the Ageing index (from the ratio 114 in 2010 to 252 in 2050).

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