

The possibilities of text mining in the examination of the local society of the Ormánság region¹

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THE AIMS OF THE PAPER

This paper aims to represent the background of the consumer behaviour in families from underprivileged strata living in small settlements of the Ormánság region.

METHODOLOGY

Our diagnoses are based on interviews with mayors. We use text mining methods for deeper analysis of the interviews and present results with different visualization techniques. With the help of comparative word clouds, we performed the support of the examination of settlement clusters created through using the quantitative data.

MOST IMPORTANT RESULTS

According to our experimental work, the method is suitable for making the results of interview research more targeted, sophisticated and to demonstrate the results. Our experiences gathered in the course of the research indicated the importance of the size of the corpus, and the necessity of using specific knowledge when supporting sociological research with text mining.

RECOMMENDATIONS

Ormánság micro region (South Transdanubia, Hungary) is characterized by a frittered settlement structure, low economic figures, and disadvantageous social processes. Adult members of families living in the culture of poverty are not able to deliver the patterns and motivation for social and economic advancement for their children, neither the values or norms for the conventional organizing of everyday life. Illogical consumer habits (“Carpe diem” mentality, commercial credit, purchasing status symbols etc.) are deepening the social gap and segregation and confining the accidental chances for self-care. Complex supporting system is necessary with the elements of labour market incentives, consulting, mentoring and development of competencies.

Keywords: culture of poverty, data visualization, text mining, underclass

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INTRODUCTION

The subjects of the analysed interviews were the mayors of Ormánság, who were asked about the problems and opportunities of their settlements. The material of the 25 interviews prepared in 2010-12 provides insights into the state of the local communities, their cultural life and the consumption behaviour of the population, in addition to a general description of the villages. Our main questions were: How can the heterogeneity of the settlements, settlement clusters be detected in a uniformly disadvantaged region? Can text mining be used for the characterization of categories identified on the basis of statistical data? Can the consuming characteristics typical for each settlement category be presented with the help of text mining? Can text mining support the qualitative interview method through the results of the processing the textures concerning the villages?

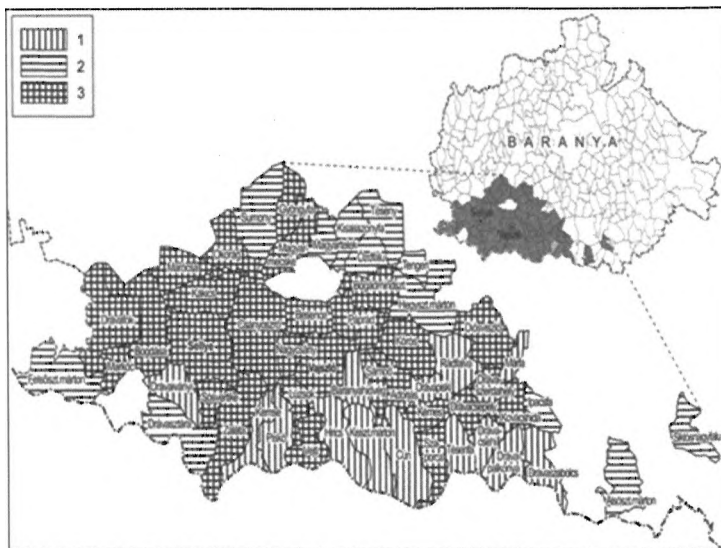
The groups of villages were created on the basis of hard indicators characteristic for the settlements, thus sorting them into categories of development (Ragadics 2015). The comparison of thematically corresponding text sections belonging to the separate blocks was carried out with the method of text mining. We used a self-created Python programme for processing the corpus created from

the interviews. We demonstrate our results with different types of word cloud presentation methods, including the comparative word cloud used at the examination of the settlement groups. We support the results from the conventional processing of the interviews with the help of visualization.

VILLAGES IN THE ORMÁNSÁG REGION

The historic micro region of Ormánság is located in the south of Baranya county, on the floodplains of the Drava. The bordering of the area can mainly be defined on the basis of its ethnographic characteristics: traditionally, 45 Calvinist Hungarian villages were listed in the region (compare with Kiss 1937). Ormánság – demonstrating the ailment of the Hungarian society – has been in the focus of scientific interest on several occasions. First, it was in the focus in the first half of the 20th century due to the birth control leading to significant economic advantages, and in the second half of that century, due to the large increase of the proportion of the Roma population. Today, economic and social problems have become interlinked, and, crossing the borders of the region, have created a continuous crisis area.

Figure 1: The map of Ormánság



Source: own construction

Legend: 1 –The settlements of the historic Ormánság (Kiss Géza 1937); 2 – Settlements involved in the research; 3 – The settlements of the historic Ormánság and the settlements involved in the research

The traditionally closed border region lies far from the hubs of development. The local social care system is underdeveloped and deteriorating, transportation is complicated due to the dispersed structure of the area. The number of local workplaces has dropped dramatically following the change of the regime, and the opportunities of communing have become limited as well. The structure of village societies has eroded: the educated and young residents have moved away, the proportion of disadvantaged population has increased, and ethnical segregation is high (Ladányi & Virág 2009). However, the fate of small settlements is different depending on their features, opportunities and social conditions. The extent of the local underclass² is a key factor concerning the future of the villages.

Ormánság – Local societies of deprived consumers

In addition to the above indicators, another significant factor of differentiation – in connection with the trends of migration due to negative causes – are the composition, quality, demographic characteristics and life opportunities of the population. By opportunities, in a consumer society we primarily mean the ability to access services and consumer goods: *"In a consumer society, a 'normal life' is the life of consumers"* (Bauman 2004, 38). Even for groups with low, irregular income the desire for possessing certain devices (e.g. smartphones) or luxury goods (e.g. well-known alcohol and tobacco products) is given as a norm. Veblen describes this phenomena as the presentation of „decency”: *"No class of society, not even the most abjectly poor, foregoes all customary conspicuous consumption. The last items of this category of consumption are not given up except under stress of direct necessity"* (Veblen 1899/2001, 85)

The consumer habits of those living in permanent poverty – based on the interviews – correspond to the „culture of poverty” phenomenon described by Oscar Lewis (1966). Individuals and families who occasionally receive money but otherwise experience permanent poverty react with a strong consumer compensation, complying with the challenges of consumer values. Instead of a methodical budget management, in their case the rapid outflow of income can be observed. This behaviour makes recovery from poverty impossible and

consolidates the disadvantaged condition: *"People in a culture of poverty produce little wealth and receive little in return. Chronic unemployment and underemployment, low wages, lack of property, lack of savings, absence of food reserves in the home and chronic shortage of cash imprison the family and the individual in a vicious circle"* (Lewis 1966, 21).

Permanent unemployment leads to the significant increase of spare time in the world of lagging small settlements. Permanent inactivity deteriorates skills, undermines the motivation levels of the affected groups, decreases the skill of self-care and increases vulnerability. In addition, it results in severe frustration. Spare time is the time for consumption, and those living in poverty are unable to use this endless free time in accordance with the requirements of consumer values (Bauman 2004).

Even the low, hard-earned income flows out from the villages of Ormánság. This is facilitated by the mobile-vendors who appeared after the degradation of local retail trade, by the local governments organising shopping trips to nearby hypermarkets and taxing their own entrepreneurs. The culture of poverty facilitates this process. Complex training, the conscious development of the self-care skills would be necessary to break the vicious circles.

Several dozens of interviews were performed in the course of the research of the local society of Ormánság (Ragadics 2015). Currently the digital version of 25 interviews is available, where the interviews are organised along seven questions. The interviews were typically made with the leaders of the settlements. By using the tools of text mining we looked for a possibility of supporting the analysis of the texts and the clear presentation of the results.

TEXT MINING

Due to the availability of a large quantity of textual contents digitally, text mining is becoming increasingly widespread. Through the development of the technology, of algorithms, the mechanical analysis of the information contained by the text has become available for the experts of social sciences. The primary aim of text mining is to search for patterns using unstructured data: documents, articles, text flows, news, notes, products of social networks (short texts), multimedia contents. (Creese 2004)

² A status under the level of society, outside the structure of society, permanent, lifelong exclusion inherited from generation to generation (Wilson 1987).

Fan et al. (2005) provide a possible definition of text mining saying that it is the investigation of new, previously unknown information with computers, through automatically obtaining information from various written sources. As opposed to numerical data, in case of text-based inputs dependency on language is a real problem, as the texts have been written in a natural language (e.g. in Hungarian, English). In order to tackle this problem, semantic and taxonomic examinations of the input can constitute an essential element of text mining. We did not perform such examinations in our current study.

The fields of text mining

The primary aim of text mining is the analysis of the information, and the secondary aim is to carry out the search. Text mining provides an opportunity to look behind the information: to drill, analyse, compress and, through these, to support decision-making. These aims are facilitated by several software and hardware, whose development has enabled the examination of data of increasingly wider sources. These software and algorithms

mainly focus on learning from the text and from various data from other sources.

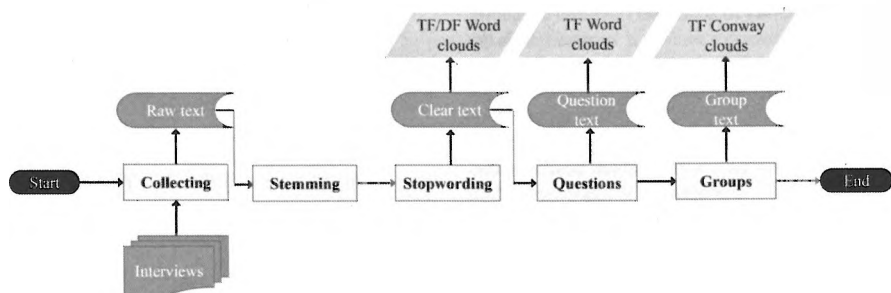
Textual data can be defined as the mass of letters and words, however, for deep examination the knowledge of semantics can be necessary. In special areas (medical databases, examination of the web) or when analysing natural languages, semantic examinations have an important role, especially in the case of obtaining data, through which the secondary meaning of the text can also be obtained (Aggarwal & Zhai 2012).

In the typical future directions of usage and research, due to the huge increase in the quantity of textual data, the development of new methods is expected. With the use of interdisciplinary data, text mining can be the bridge between researcher groups working in different areas of science.

THE APPLIED TEXT MINING PROCESS

Figure 2 shows the process of text mining applied in the research.

Figure 2: Process flow of our method



Source: own construction

The prerequisite of text mining is an existing text base, which can be analysed after various steps of preprocessing and purification. In the first step, it is necessary to gather the text base that will be the subject of the analysis, which, in the case of the present research, was the digitalised text material of the sociological interviews previously prepared in the Ormánság region. The raw corpus resulting from this step was the basis of further processing. The next step we performed on the raw corpus was to purify it from incomplete, incorrect data. This stage requires significant human labour, especially due to the fact that this activity can

only be performed with the help of an expert proficient in the topic. The sociologist expert participating in the research created a new version of the corpus especially relevant to the given domain by removing the parts irrelevant to the content, while the main text does not suffer any loss of information concerning its content. This stage also included a significant step which is essential in the case of the Hungarian language: the examination of the character encoding of the digitalized documents. In the case of the Hungarian language checking the encoding forms used for the correct presentation of the accented letters (e.g. ISO-8859-2) and the

avoidance of anomalies resulting from encoding conversions during the processing of the text are of special importance. As a result, a textual corpus suitable for mechanical processing was created.

In the first step of the stage supported by computers, with the help of tokenization, as opposed to breaking it down into sentences which happens in natural languages, we created smaller elemental units which can relatively clearly be determined in texts. In the case of the present research, these units were individual words. The group of tokens, that is, character series of identical content are called types, which are the components of the dictionary created from the corpus. Language-specific solutions have been developed for the performance of the task (Tikk 2007). In the present research, we carried out the automatic tokenization with the help of the Hungarian dictionaries and algorithms of the Hunspell programme package. As a result of breaking down the text down into words, the units that do not carry any content information became visible, and were removed from the text through the step of removing stop words. As a result, the size of the corpus to be analysed can be reduced significantly. The further reduction of the size without loss of information can be solved through stemming. Its aim is to trace back the modified versions (inflection, suffixes) of the words identified (tokenized) in the corpus to their stems, while its aim is to reduce the vector space, as the identical words are contracted in a common canonical form pl. *büszkeség / büszkék / büszkén* → *büszke*.

The scale of reduction is different depending on the language, the grammatical structure of the given language: in the case of the Hungarian language it can be up to 90%, as opposed to the 50% value of the English language (Tikk 2007). The result of stemming, as opposed to linguistic lemmatization, is not always a meaningful stem form. Various methods of stemming are known (e.g. NLTK Snowball, Hunmorph). In the present research the stemming algorithm for Hungarian language of the Hunspell programme package was used.

The main challenge of analysing texts lies in the fact that documents created in human (natural) languages can only be processed with a computer, that is, by converting the text into an artificial language. Documents can be represented through three, fundamentally different approaches: set theory, algebraic, probability. In the case of the set theory approach, the similarity of documents is approached through set operations, in the algebraic approach it happens through matrix operations, while in the case of the probability approach, it is performed through probability estimations (Tikk

2007). In the case of the present research the similarity (distance/proximity) of the documents could be determined with the help of the vector space model created through the algebraic approach. The basis of the model is the vocabulary of the examined documents, while the level of their similarity lies in the extent of the overlapping of this vocabulary.

That is, if D , where vector D is identical to the document collection of our corpus, in which the d elements refer to the individual documents. In the vector space, we represent the individual documents with the vector created from the words contained in the documents, A , where vector d consists of M number of words of document i (the frequency of those words). We can summarize the corpus compiled from the documents with the help of the Term Document Matrix (TDM).

$$D = \begin{bmatrix} d_{11} & d_{12} & \dots & d_{1N} \\ d_{21} & & & A_{2N} \\ \vdots & & & \vdots \\ A_{M1} & A_{M2} & \dots & A_{MN} \end{bmatrix}$$

In the D TDM matrix the number of the lines corresponds to the number of unique words (M), while the number of columns is identical to the number of documents constituting the corpus (N). The element of the TDM matrix contains the relevance of word i in document j . In the TDM matrix the position of the words within the document is lost, thus this technique is also called “bag of words” model (Tikk 2007).

Visualizing text mining results

The wide-spread solution for the presentation of text mining results are word clouds, which enable the concise, compact visualization of the information included in the texts and the data connected to them. When the text is processed, the word clouds created from the natural text present the words most typical for the text or appearing most frequently therein.

The word cloud was first applied in the work of Stanley Milgram in the mid-1970s, used for a presentation based on quantitative values connected to words (Milgram & Jodelet 1976). The computerised support and presentation of word clouds became wide-spread from the second half of the 1990s, and this technique has become part of today’s data visualization (Viégas & Wattenberg 2008). During the past years, various solutions have been developed, the most significant are the

following: Wordle (Feinberg et al. 2009), Prefix (Burch et al. 2013), SparkClouds (Carpendale et al. 2010). The shortcoming of the word clouds that can be considered conventional is that they are only suitable for the presentation of one single corpus, but are unable to present further background information. The comparative word cloud was created for the simultaneous examination of several corpuses, and also provides a more comprehensive image of the differences and similarities of two corpuses.

We applied two techniques in our research: conventional word clouds and comparative word clouds. The combination of these two techniques and their application in the characterisation of clusters was developed by Kruzslicz and colleagues. In their method, the scale of separateness of two document clusters is determined by the quality of individual words and the „butterfly shape” of words concentrated on the two edges, which is visualized with a comparative word cloud. The cohesion of the clusters is expressed by the proportion and position of large- and small-sized words. Thus, we can receive a visual confirmation of the extent the objects included in the two clusters are grouped around each concept. The method determining the quality of clustering is based exactly on this observation (Kruzslicz et al. 2016). Process of the cluster evaluation through labelling, applied in our research is the following:

1. Clustering the objects which are the settlement groups created in a previous research on the basis of quantitative data.
2. Assigning related documents, that is, the interviews performed in the settlements, to the objects.
3. The weighted list of the potential labels of the document sets assigned to the clusters, which are based on the TDM matrixes created from the corpuses.

4. Preparing comparative word cloud from the words of the labels by cluster pairs.
5. Forming an opinion concerning the delimitation and definiteness of each cluster with the help of comparative word clouds.

RESULTS

In our research, we carried out three different examinations on our corpus containing the text of the interviews. In the first step we generated Term Frequency (TF)/Document Frequency (DF) word clouds for the entire corpus, that is, for all of the interviews, then with the help of TF word clouds generated from the seven corpuses created through summarising the interview by questions, we attempted to drill deeper in order to explore hidden information in the responses, and finally, through the text mining analysis of the interviews assigned to the clusters (settlement groups) created by a sociologist expert in a previous research, we aspired to provide a more accurate description of the clusters.

Base statistics

The 25 interviews involved in the corpus were organised along seven questions, to which responses of various sizes (length) were given. The text mining analysis of the responses given to the questions is determined by the size of the available text material. Table 1 shows the heterogeneous distribution of the size of the responses, ranging from 14 characters (question 3) to 4813 characters (question 1). Thus, it was not possible to analyse the questions for each interview, however, by contracting the responses of the interview questions, the aggregated text content of the seven questions made the examination possible.

Table 1: Statistics of interview question's answers in numbers of characters

| Question ID | Question texts | Avg. Length | Min. length | Max. length |
|-------------|--------------------------|-------------|-------------|-------------|
| 1 | Introduction of village | 1043 | 113 | 4813 |
| 2 | Relations to settlements | 749 | 98 | 3482 |
| 3 | Local community | 1278 | 14 | 3732 |
| 4 | Local traditions | 868 | 174 | 3332 |
| 5 | Local opinion leaders | 427 | 65 | 1573 |
| 6 | Plans for the future | 1160 | 147 | 3619 |
| 7 | Consumption | 490 | 162 | 2864 |

Source: own calculation

The examined settlements were divided into three groups on the basis of a number of indicators³. The first group indicates a high level of population decline (1990-2011), low qualification, high unemployment and crime rates, and the stronger presence of the Roma population. The second represents the mid-range in Ormánság. The third group shows lower than average population decline, higher employment and qualifications and lower crime rate and a lower proportion of the Roma population. For the appropriate interpretation of the above, a number of factors must be taken into consideration:

1. The absence of population decline does not necessarily mean a stable, developing society, in the slums of the poor a population increase was observed in the recent period.
2. A low level of education can indicate a high number of children.
3. The high unemployment rate can indicate a high rate of inactive people.
4. Criminal statistics only include the reported crimes, legal awareness and the proportion of using police assistance can be lower in the case of the vulnerable population.
5. Belonging to the Roma population is based on self-declaration, willingness to response is uncertain, and the proportion of refusing to admit a Roma identity is high.

6. The two largest settlements of the Ormánság – in order to enable the easier comparison of the villages – were not included in the sample.

On the basis of the above factors, the micro centres of the Ormánság become visible, such as Drávafok and Kémes, which have above-average population and several local institutions (e.g. schools), in addition to some small settlements of more favourable social structure. The villages in the worst situation, thus obtaining low scores, included e.g. Kórós, Marócsa, Okorág, Ózdfalu and Sumony. The group of villages representing the middle level includes a wider range of settlements with mixed indicators.

Table 2 shows the statistics of the interview contents assigned to the triple cluster group created through the expert's grouping on the basis of this settlement typology. The heterogeneous composition of the text base of the three groups can be observed, which forecasts the limitations of the text mining support of cluster evaluation concerning each pair of groups. The significantly low average length of the interviews of group 1 makes examination with comparative word clouds more difficult, while in the case of the other two groups the average length of the interviews makes the examination easier.

Table 2: Statistics of interviews by village groups

| Group ID | Villages | Avg. length | Min. length | Max. length |
|----------|--|-------------|-------------|-------------|
| 1 | Drávafok, Drávasztára, Kémes, Drávacsépe | 3444 | 1426 | 6119 |
| 2 | Besence, Hegyszentmárton, Ipacsfa, Sósvertike, Adorjás, Diósviszló, Drávaszerdahely, Nagycsány, Páprád, Sámód, Sumony, Szaporca, Tengeri, Tésény | 5884 | 2350 | 13821 |
| 3 | Kákics, Marócsa, Ózdfalu, Cún, Kórós, Lúzsok, Okorág, Ózdfalu, Vejti | 7036 | 1259 | 18023 |

Source: own calculation

³ For further details, see Ragadics 2015.

Through studying the word clouds, the following conclusions can be drawn, presented in Table 3.

Table 3: Textual analysis of the responses given to the questions

| Question ID | Question texts | Frequent words |
|-------------|--------------------------|--|
| 1 | Introduction of village | idős – segély – cigány – vég |
| 2 | Relations to settlements | ház – ivás – akar/tud – elmegey |
| 3 | Local community | dolog – rég – mer – egymás – irigység |
| 4 | Local traditions | hagyomány – bál – falunap – tud – nyugdíjas |
| 5 | Local opinion leaders | képviselő – hallgat – csinál – hisz |
| 6 | Plans for the future | pályázat – kormányzat – önerő – munka |
| 7 | Consumption | vállalkozó – hitel – kap – ünnepe / TESCO / kocsmá |

Source: own compilation

The results of the text mining examination of the interview extracts grouped around the seven topics provide an insight of the situation of the examined small settlements. When we asked mayors to describe their settlements, statements concerning aging, marginality appeared in high numbers. They deemed it important to mention the high number of people living on benefits and the high proportion of the Roma population. This negative attitude appears in the relationship of the residents and the village. From the point of view of mayors, only those residents remain in the settlements who are unable to leave. It is difficult to sell residential homes, and it makes moving to more developed areas impossible. The most serious problem according to settlement leaders is the fragmentation, disintegration of local society and the lack of a local community. In the centre of this block of questions is the expressions „irigység” (envy). Local traditions and culture is appropriately reflected by the words „bál” (ball), „falunap” (village festival), „nyugdíjas” (pensioner) appearing in the word cloud. The elderly are the most active class in terms of preserving traditions, as there are pensioners’ clubs in several settlements. In settlements possessing rich cultural values, today only a very small group of residents is connected to the heritage of the Ormánság (in several settlements these customs have completely disappeared). Local culture manifests itself in the

village festival and the periodically organised balls. The population is characterised by a significant passivity, the majority of the locals are primarily attracted to the programmes by food, drink and music. Key expressions indicating activity only appear in the case of the local government representatives considered to be opinion leaders. The future of the settlements is determined by the scale of external help. This is the reason why this group of questions contain the words “kormányzat” (government) and „pályázat” (tender) and the concept of „önerő” (own contribution) which means a serious burden. The expressions appearing in the questions concerning consumption also demonstrate the characteristics connected to disadvantaged consumers very effectively: loan, as the basis of consumption, aid packages distributed at holidays, and, in addition to food donation, the name of the pub and that of a hypermarket appeared in the word cloud.

Examining village groups

We applied the method on the corpuses created from the groups of interviews divided by the expert. The textual transcript of the interviews performed in the settlements divided into three clusters was assigned as documents to the groups, thus we received three groups of documents. Thereafter the list of word frequency (TF) of the potential labels

SUMMARY

On the whole, it can be said that word mining applied as a complement to qualitative interview examination can provide the analyst with a form of quantitative confirmation. Naturally it does not promote the deep interpretation of the text, it does not replace in-depth interview techniques, but it can make the analytic work more sophisticated and – by indicating the appropriate key expressions – focuses it on the essential content. Besides, it presents the examined scope of issues in an understandable way. Contrasting the different settlement groups yielded less success. The important concepts characterizing the given cluster also appear in this comparison, however the description of the character of the different village groups is not expressive, and it does not converge with the other results of the research. A more accurate work can possibly be carried out with a larger text and the detection of individual collocations. The key expressions only appearing in the case of one or the other settlement type can provide important, useful information complementing the technique of in-depth interviews. The further exploration of the possibilities of applying text mining in social science requires further work and interdisciplinary cooperation.

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