



## Measurement of Customer Satisfaction through Emotion Analysis in the Banking Sector

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# Measurement of Customer Satisfaction through Emotion Analysis in the Banking Sector

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**Abstract** - Customer satisfaction plays an essential role in financial institutions. Particularly in the banking sector, a series of customer satisfaction studies is carried out in order to ensure the continuity of the customers with the bank. The most important ones of these are; questionnaires, feedback from the branch staff, and the increase in the client's banking transactions. By analyzing these studies, the satisfaction level of the customers can be measured. However, these measurements do not have a complete mathematical accuracy and can be misleading. In this study; the facial image of the customers who come to the bank are perceived by the camera and evaluated by emotional analysis. In this way, it is determined that the customer is satisfied or non-satisfied when leaving the bank. Problematic banking applications are also identified with the help of the analytical result of emotional analysis. In addition to this, the branch personnel of the bank who behave well to the customers are determined and performance evaluation is made more accurately.

**Keywords** - Emotion detection, customer satisfaction, emotional analysis, sentiment analysis, facial recognition

effective and correct way to increase customer loyalty is to provide quality service to customers [1]. The importance of customer satisfaction cannot be denied for any business. Because it is much more economical to keep existing clients in the long term than to find new customers [5].

Due to the effect of the increasing rivalry, a great intensify is experienced in the usage of technology related to our world's banking in recent years. Banks rapidly are trying to enrich their classical technological products such as ATM, POS, telephone and computer banking with new products and new service concepts. In this respect, the concept of electronic banking in the vision of all banks is in the top of the list. Banks are introducing new applications such as "Call Centers", "Internet Banking", "Mobile Banking" and "Customer Relationship Management" in order to provide better services to their customers and to provide 24-hour service. If the feedbacks from all these services are positive, we think that the customers are satisfied.

## I. INTRODUCTION

Banks are financial institutions within the service industry in terms of their structures [1]. In today's competitive market, positive relationships between banks and customers are a dominant factor for business. In the banking sector it is generally adopted as a customer-centric approach. Therefore, customer satisfaction is considered as the unique factor on providing the best service [2]. Customer's satisfaction related to product or service affects the positive and negative perceptions of the product or service. For this reason, banks have to learn their feedback of their product or service satisfaction in order to make their customers more loyal [3]. Taking decisions in the direction of customer satisfaction is only possible by having information about customer behaviors. Customers' satisfaction depends on that they compare the service we give them with the expectations they have. The customer is satisfied when the customers' expectations are fulfilled. Even if the service is above the expectations, the customer is highly satisfied [4].

Banks try different methods to retain available customers and to gain new customers. In addition, banks attempt to increase the number of products available customers use and to provide in-house customers increase their usage of other services. The main purpose of these works is to provide customer satisfaction. Banks gain the loyalty of customers by ensuring the continuity of customer satisfaction. The most

Table 1: Causes of participants' bank preferences

Causes	First Important Cause		Second Important Cause		Third Important Cause	
	frequency	%	frequency	%	frequency	%
Reliability	81	61,4	3	2,3	2	1,5
Physical properties	5	3,8	7	5,3	1	0,8
Compliance with credit conditions	9	6,8	17	12,9	8	6,1
Interest, welcome and respect	8	6,1	28	21,2	13	9,8
Easy access	4	3,0	27	20,5	10	7,6
Banking operations	4	3,0	13	9,8	5	3,8
Credit card	0	0	8	6,1	15	11,4
Internet banking	2	1,5	8	6,1	8	6,1
Call center	0	0	3	2,3	5	3,8
Service variety	1	0,8	5	3,8	21	15,9
Deposit high interest rate	1	0,8	2	1,5	5	3,8
Quick result of the process	7	5,3	1	0,8	25	18,9
Other	2	1,5	0	0	0	0
Total	124	93,9	122	92,4	118	89,4
No reply	8	6,1	10	7,6	14	10,6
Grand total	132	100,0	132	100	132	100,0

As seen in Table 1, participants indicated reliability (61.4%) as one of the three most important reasons for choosing a bank. The second important reason was interest, welcome and respect (21.2%) and the third one was the quick result of the process (18.9%) [6].

In this study, we will try to determine customer satisfaction realistically through emotional analysis in order to provide customer satisfaction which is the main aim of banks. With the help of the Microsoft Cognitive Services Face API, the emotional state of the customer being at the bank is detected with certain periods. Then, by reporting, it will be determined which banking transactions have problems and which staff are more favorable to the customers. In this way, the 2nd and 3rd important causes mentioned in Table 1 have been ensured.

## II. EMOTION TAXONOMY

According to the emotion theorists and psychologists, various of emotions can be categorized by starting from globally showed six fundamental emotions to complicated emotions which are originated from different culture with. The following theories are mainly used in emotion analysis studies; Ekman and Friesen's List of Basic Emotions (1971), Plutchik's Wheel of Emotions (1980) and Parrots' Classification of Emotions (2001). Ekman and Friesen in 1971[7] put forward six quintessential basic emotions like disgust, joy, sadness, fear, anger and surprise which are globally presented and identified from facial expressions. Microsoft Cognitive Emotion API results give us Ekman and Friesen's fundamental set of emotions. Therefore, customers will be evaluated through their list of basic emotions.

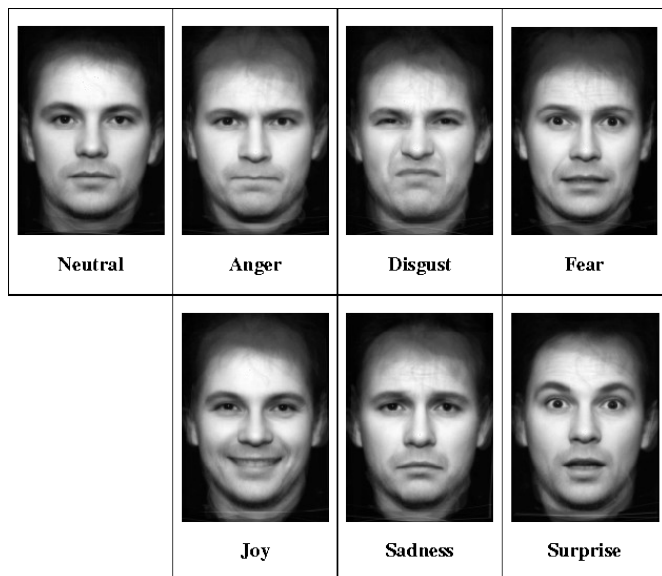


Figure 1: Ekman and Friesen's List of Basic Emotions.

## III. IMPLEMENTATION

The emotional analysis of the customer is made with a structure that can be integrated into the banking application. The main aim for taking part in banking application is to get the transaction and employee information. In addition, there must be a camera connected to the branch staff's computer.

The general model of emotion analysis integration is shown in Figure 2.

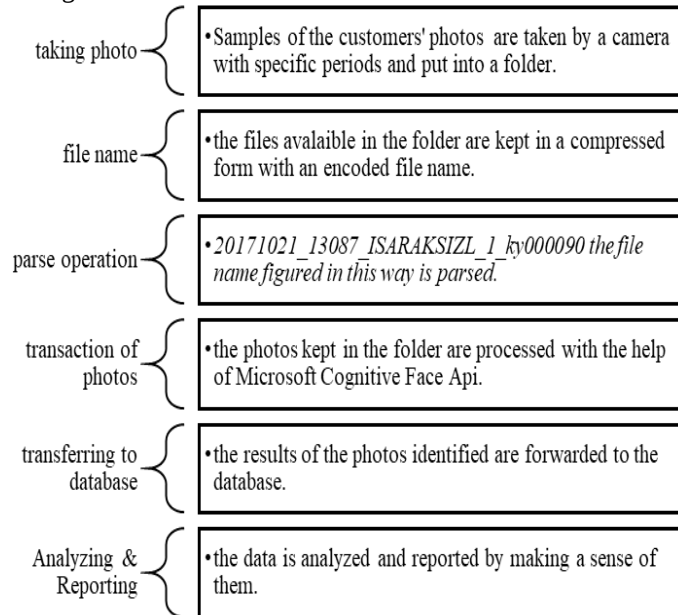


Figure 2: Generalized Model for Emotion Analysis.

### A. Taking Photo

Samples of facial expressions are gathered in specific periods by a camera during the operation of the customer's request as seen in the Figure-3. The samples collected are put into the folder to be operated. The reason why the photos aren't processed as soon as they are taken is that the customer shouldn't lose any time while his operation is being done.

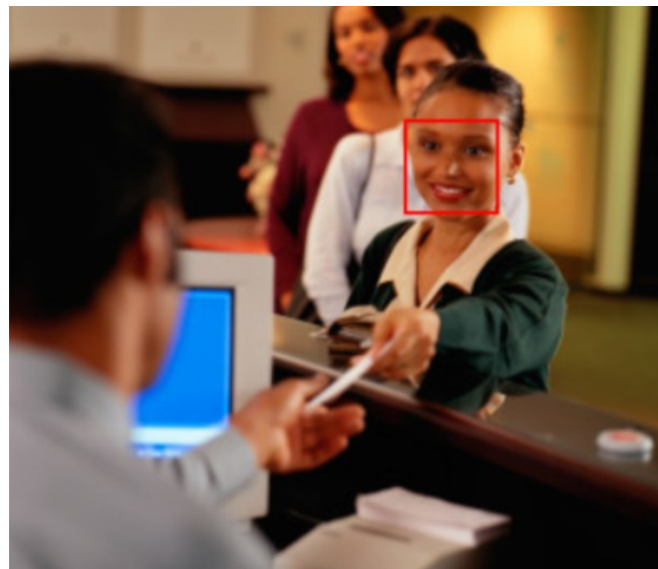


Figure 3: Taking customer's photo by a camera.

### B. File Name

The names of the files are saved into the folders in a specific form as compressed. The example is seen in the Table-2.

Table 2: Sample of file name format

20171021_1400_ISARAKSIZL_1_bk000207.7z
20171021_13087_ISARAKSIZL_1_ky000090.7z
20171021_43679_ISARAKSIZL_1_gy000114.7z

### C. Parse Operation

The samples of the photos saved are kept in zipped files. The result in the Figure-3 consists when we parse the file name. The areas of the file names are separated from each other with an underline (\_). From the left, the date of the operation done is in the first tab, the client no processed in the bank is in the second tab, the screen information belonging to the process done in the banking application is in the third one, the information of the branch office in which the operation is done is in the fourth tab, the information of the staff who is carrying out the operation is in the fifth tab.

20171021_13087_ISARAKSIZL_1_ky000090.7z				
20171021 (Process Date)	13087 (Customer Number)	ISARAKSIZL (Screen Code)	1 (Branch Code)	ky000090 (Personel Code)

Figure 3: Parsing file name

### D. Transaction of Photo

After the parsing, identifying the photos is started with the help of Microsoft Cognitive Face API. Firstly, to gain an API key by doing a recording on the platform of Microsoft AI + Machine Learning is needed for this operation. We use this key while processing the photo.

We take the output of the processed photo as a data set on the form of JSON. The finding of the operated photo in the Figure-1 can be observed in the Figure-4. We conclude after the process that the customer is really satisfied in the second when the sample of the customer's photo is taken and processed.

```
"emotion": {
  "anger": 0.0,
  "contempt": 0.0,
  "disgust": 0.0,
  "fear": 0.0,
  "happiness": 1.0,
  "neutral": 0.0,
  "sadness": 0.0,
  "surprise": 0.0
},
```

Figure 4: Result of the processed photo

### E. Transferring the Database

We save both the result of the data processed in JSON form and the name of the zipped file in the database after parsing. A number of photos belonging to the customer are available since we take the samples of the customer's photos in specific periods.

### F. Analyzing & Reporting

The outputs inset into the database are evaluated according to the processes of the branch office, the staff and the banking applications. When the records evaluated in the branch-based are analyzed, we learn that which branch is welcoming the customer in a better way for performance. In this way, we detect the behaviors' the branch staff. We also use this information in the evaluation of the staff performance. Finally, the problematic ones of the banking applications are found. For instance; imagine that it is detected some clients are not satisfied during the process of a telephone bill. In this situation, we decide there is a problem in the integration of the telephone bill process and all the actions are carried out by the Unit of Information Technology to resolve the problem.

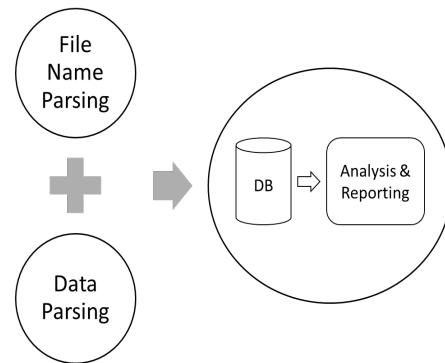


Figure 5: All transaction process of the data

## IV. RESULT & ANALYSIS

After the images of customer are processed, the result in Table 3 occurs. In this way, the transaction-based results of the customer can be examined. When we review it in general, we find that the customer is satisfied according to the result. Any anger did not occur.

Table 3: Result of a customer's process

EmotionId	ProcessDate	BranchId	CustomerId	User Code	ScreenCode	Anger	Contemp	Disgust	Fear	Happiness	Neutral	Sadness	Surprise
0	2017/02/06	1	13087	ky000090	ISARAKSIZL	0	0	0	0	1	0	0	0
1	2017/02/06	1	13087	ky000090	ISARAKSIZL	0	0	0	0	1	0	0	0
2	2017/02/06	1	13087	ky000090	ISARAKSIZL	0	0	0.81	0	0	0.19	0	0
3	2017/02/06	1	13087	ky000090	ISARAKSIZL	0	0	0	0	0.86	0.14	0	0
4	2017/02/06	1	13087	ky000090	ISARAKSIZL	0	0	0	0	0.78	0.22	0	0
5	2017/02/06	1	13087	ky000090	ISARAKSIZL	0	0	0	0	1	0	0	0
6	2017/02/06	1	13087	ky000090	ISARAKSIZL	0	0	0	0	0.87	0.13	0	0
7	2017/02/06	1	13087	ky000090	ISARAKSIZL	0	0	0.9	0.1	0	0	0	0
8	2017/02/06	1	13087	ky000090	ISARAKSIZL	0	0	0	0	0	1	0	0
9	2017/02/06	1	13087	ky000090	ISARAKSIZL	0	0	0	0	0	1	0	0
10	2017/02/06	1	13087	ky000090	ISARAKSIZL	0	0	0	0	1	0	0	0
11	2017/02/06	1	13087	ky000090	ISARAKSIZL	0	0	0	0	1	0	0	0

The most important outcomes of Ekman and Friesen's List of Basic Emotions are the anger and happiness. These two emotions, give us the most definitive result for the customer.

When we examine the Figure-6, we see that the customer is leaving the bank happily. In this way, we assume that the customer will be in connection with the bank again. It is a good progress for the bank's profit.

However, if we look at the linear line of happiness while the customer is in the bank, we can see that the happiness of the customer goes down and the neutral situation tends to increase. This situation is not a problem for the bank because

the neutral situation does not give us an exact result. Figure 7 and Figure 8 show the linear line of happiness and neutral status. If the customer was angry instead of neutral, then we could say that the customer came to the bank happily, but he was angry when he left. We think that this customer is not satisfied.

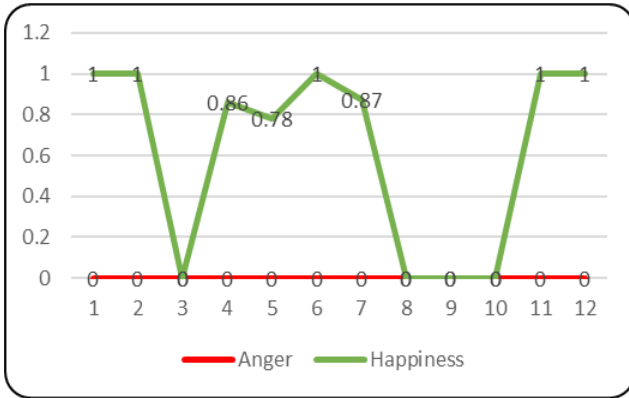


Figure 6: Anger and happiness status of a sample customer

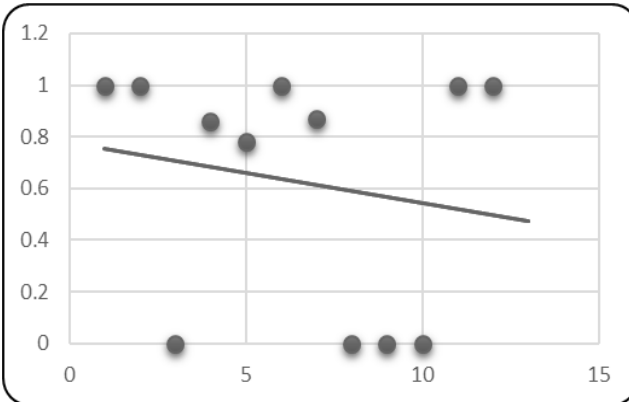


Figure 7: Linear result of the happiness status

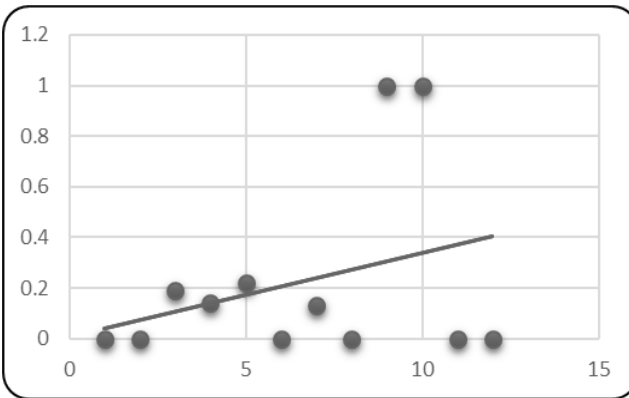


Figure 8: Linear result of the neutral status

## V. CONCLUSION

In this study, we conducted emotional analysis with the aim of measuring customer satisfaction. In this way, it is aimed to increase the banking income by ensuring the continuity of the in-house customers. Additionally, problematic banking applications are identified and fixed by the Information Technology Unit. Besides, the staff who does

not show good behavior towards the customer can be detected. Lastly, branches and branch staff behaving well are rewarded and rivalry can be ensured.

Today all of the existing vision systems for facial muscle action detection deal only with the frontal-view face images. It should be noted that, some people may not show their emotion and mental state by facial expression. It will be more accurate to examine their emotions through sound analysis as well as the image of these people.

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