The Applicability of Voice Conversation on Detecting Intentional Loan Default in P2P Lending Industry

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Abstract

FinTech (Financial Technology) is a series of innovative trends that may change the future direction of the global financial industry. Among them, the Korean P2P lending platform has grown very rapidly, and it has now reached a level where it threatens the secondary financial market. However, as its growth rate has increased, potential risk factors are also increasing. Apart from government legislation to protect and regulate P2P lending, additional measures to reduce the risk of P2P loan accidents have not yet followed the pace of market growth. In this study, we analyzed telephone consultation voices, which have not been applied to P2P loan examination so far, and examined whether they can be used to judge if a borrower will default or not. Experimental results show that the change of pitch frequency and the variance of voice pitch frequency may be reliably confirmed, and that this difference can be used to predict defaults or to determine the default risk.

keywords: P2P lending, P2P Default, Phone Consultation, Speech Analysis, Voice Characteristics

1. Introduction

FinTech (Financial Technology) innovations may well change the future of the global financial industry. FinTech can be regarded as a business model innovation activity that challenges and replaces existing traditional business models in the financial arena. In other words, the essence of FinTech is finance, not technology. This business model innovation means a dramatic differentiation in two key factors: 'Value Proposition' and 'Operating Model'. [1] Since the year 2000, FinTech innovation has been taking place in various fields such as payment, security, financing, and asset management in the global market. To this end,
ecosystem-centered FinTech innovation, which is dominated by platform operators, has a competitive advantage.\cite{2} The platform means that many people can easily access and use it for various purposes.\cite{3} In the digital environment, the platform has a huge network effect, so it has become a minority oligopoly system. For this reason, it can only be applied to specific areas of the leading providers such as search engines like Naver or Google, communication platforms like KakaoTalk, and e-commerce providers such as Alibaba, G-Market, and Auction. In particular, the domestic P2P lending platform, which started to grow rapidly by the end of 2014, has continued to grow very steeply and now threatens the secondary financial market. However, as its growth rates have increased so too are potential risk factors also increasing. Apart from government legislation to protect and regulate P2P lending, additional measures to reduce the risk of P2P loan accidents have not yet followed the pace of market growth. The government has proposed P2P loan guidelines to prevent P2P loan accidents, but P2P financial loan information is not shared with financial institutions nor reflected in credit ratings used by credit evaluation agencies.\cite{4} It is also pointed out that P2P financing, which deals with high-interest loans, attracts second-tier financial customers whose security and credit are weak, so there is a risk of increasing the debt information gap and of multiple debts. According to the banking sector, information about customers who borrow from P2P financial companies cannot be obtained by existing financial institutions. This is because all P2P financial companies are excluded from the collection targets of the Korea Credit Information Center, which collects loan information on regulatory financial companies.\cite{5} Therefore, it is necessary to develop a P2P financial information sharing scheme and a credit rating system for P2P companies, which absorbs secondary banking customers whose security and credit are relatively weak.

Currently, twenty-nine companies have joined the P2P financial association and share their loan details through credit evaluation agencies (CB) such as NICB evaluation information and Korea Credit Bureau, in order to prevent duplicate loans within the P2P business. This firstly demonstrates a movement to share and use personal information scraping technology, which is widely used in most financial sectors.\cite{6} Further, some companies started to develop their own credit evaluation systems, and some models of beta versions have also appeared. Ernest Fund has announced that it has introduced a credit evaluation model based on a Psychometric Test, which was presented by British VisualDNA and EPL of the United States.\cite{7} This is a technique that measures the personality characteristics of the evaluator through questionnaire-type problems that have no correct answer, attempts to grasp the willpower for future debt repayment, and judges that the higher the score, the better the ability to repay money will be in the future.\cite{8}
This technique is one of the new credit evaluation methods using big data analysis. Its utility rate is especially high in undeveloped countries that have weak Internet or mobile service adoption. It can also be a potentially good solution for P2P lenders who have difficulty in checking loans because they do not have enough credit information. It allows evaluation in any area at any time, which is advantageous in terms of availability, but the drawback is that the program should be executed under the control of the lending officer. For these reasons, in our co-working study, we analyze the voices of potential borrowers that have not been applied to P2P loan examination so far and try to apply them to the credit evaluation system. Individual fingerprints and irises that have different patterns have been used as useful tools to identify people. In addition, some researches have shown that an individual’s voiceprint can also be used as a tool for identifying a person. However, unlike fingerprints or irises, voices have unique characteristics depending on the vocal cords and vocal track, and they also have dynamic characteristics that vary according to factors such as vocalization, emotion, age, health, or environment. As such, the purpose of this study is to identify the characteristics of voices before and after a credit loan, and after a loan default to identify the characteristics of a credit rating system.

2. Generating Voice and Its Analysis

A person’s voice allows for the easy communication of information between people or between people and machines. Voices are generated through the human vocal organs and then disseminate into the air before eventually disappearing. At least in the present day and age, voices remain an individual characteristic of the people who create them. Additionally, voices sound similar but each voice possesses its own unique characteristics based on an individual’s vocal organs, linguistic characteristics, personality, health, and psychological state. [10-13] When voices are analyzed, similar features are left in the form of sounds which have meanings in language, and non-similar features are caused by a variety of different causes. As people’s voices are easily used for communication, IT technologies have been developed to record voices or to transmit them far away. Nowadays, by analyzing voice information, machines can perform the commands of a person, record information, judge psychology, and set operative directions.[14] The block diagram in Figure 1 represents the flow and movement of information from the speaker to the listener. The average person undertakes this process through a number of exercises and habits to create voices, which are then easily delivered through the vocal organ, turned into vibrations, and then heard and analyzed by the ear to catch the meaning of
sounds. All this takes place in a very short time period.[15]

![Diagram of speech and hearing processes](image)

[Fig. 1] Information flow from speaker to listener [14]

Voices have parameters that give them different and unique characteristics in different individuals. This is because the forms and characteristics of vocal organs are different, just like the face of each individual is different. In addition, vocal habits caused by an individual’s social life, linguistic structures formed by commonly used vocabulary, and regional linguistic characteristics can all also be classified. Additionally, data from voice variations caused by an individual’s health and psychological conditions can also be extracted and analyzed. Indeed, voices contain more than a hundred additional features that can be analyzed and identified to convey meaning through voices, as well as to identify health and psychology, and to judge the authenticity and reliability of a speaker.[11-13] A voice generation model, which can computerize the processes of voice and sound creation and of analyzing the sounds heard by the ears, can be used in this study. A basic outline of a voice generation model is as follows: 1) Speech is divided into voiced and the unvoiced sounds according to the principle of voice generation and assumed to be an excitation source, and 2) the sound or excitation source is divided into the impulse train and vocal chord model for voiced speech, and the white sound and vocal cord model for unvoiced speech, which use the thickness, length, and the stenosis degree and stenosis timing of vocal tracts.[12-14]

People use financial institutions for a variety of reasons. The basic function of finance is to allow households, corporations, governments, financial institutions, etc. to obtain necessary funds through transactions and to manage surplus funds. The credibility or lack thereof of individuals and institutions in the financial sphere is very important information. The criterion
for assessing credibility includes evaluating past financial performance and the form of past transactions, what kind of credit a bank has, if any, and assessing the amount and degree of risk associated with a bankruptcy. In this paper, we aim to develop a personal credit rating scale through voice analysis to apply to P2P financing in today’s rapidly developing market. People try to speak well for various reasons. Most importantly they are trying to transfer their intentions in various speeches, personal conversations, sales, and even job interviews, and to clearly communicate intended information.[11-13] The voice can also be used as a measure for evaluating individual credit if voice analysis can successfully extract various analytical features and create a measure of the credibility of the voices.[16]

3. Research Method

3.1 Data Collection

In order to obtain data for this study, the participating researchers were allowed to use the recorded telephone consultation files of a loan counselor and borrowers from a domestic savings bank company (S-Capital). It was made clear, by way of a verbal commitment, that this information would only be used for research purposes. Data for the study were the telephone counseling files before the loan approval of borrowers who had defaulted within 3 months after deliberate delinquency, and the consultation files after delinquency and deliberate bankruptcy. Co-researchers in the Institute of Sound Engineering (Soongsil University) analyzed the characteristics of the voices before and after a person defaulted. From the results obtained we searched for ways to apply them to a credit evaluation system for approving loans in the future. The method of voice analysis was based on pitch, formant, and the speaker’s dependency and independency, which in turn was based on the rate of utterance of the speaker.

3.2 Data Analysis

To evaluate voice reliability, Voice data was recorded at 11 kHz by telephone, the voices were processed by using a 300-4200 Hz band pass filter, quantized by 16 bit per sample. Voice data was analyzed for fifteen men and women generally aged in their 40s and 50s. Figure 2 shows the parameters for evaluating the reliability of voices according to changes in credit ratings. The changes in credit ratings were compared between the voices in the loan review
process and the voices in default situations after the loan. In particular, the characteristics of the same vocalist’s ‘yes’ during vocalization were collected and analyzed. As a result, the rate of change of the pitch before and after the default has changed as seen in Fig. 2.

![Waveform and pitch analysis result](image)

**Fig. 2** Waveform and pitch analysis result according to reliability parameter change

Figure 3 and Figure 4 show the results of the voice waveform and pitch analyses, that is to say the results of analyzing the parameters using pitch change and pitch perturbation rate to determine the speaker’s changed credit situation. As a result, it can be seen that there is a large difference in pitch variation and perturbation in situations where the bankruptcy is suspected or not suspected. For comparison, the changes in the pitch indicated by the circles in Figure 3 are closely analyzed. The analysis confirms that the pitch change degree of Fig. 3 is constant, which means that the voice is monotonous and the change is small.

![Predictive Pitch Analysis Results](image)

**Fig. 3** Predictive Pitch Analysis Results

In Fig. 3, it can be seen that the degree of change is larger than for the suspicious voice. In Fig. 4 (c), the number of pitch changes is larger than for the other voices though it is not easy
to confirm with the naked eye. This analysis can determine whether a defect is suspected or not by measuring the change in pitch and the change in pitch dispersion against time, and judging whether the change exceeds the value or not. In particular, it was confirmed that when the speaker's subordinate analysis was performed, the pitch dispersion of the time with time, the change occurred as time passed and the psychological change was severe.

![Fig. 4] Predictive Pitch Analysis Results

4. Conclusion

A person's voice contains various additional information as well as communicating information. The voice contains more than one hundred different features besides the basic function of the communication via voices. It is a common method to analyze this voice by separating it into a excitation source and a wave filler source in consideration of the generation process. The excitation source can be analyzed with the application of vocal cord model, and the wave filter source with vocal tract. The voice is the output of a time-varying system that changes over the time. However, the changes do not occur very rapidly nor regularly over the time. And between changes and changes, similar features can be found with approximate cycles.

By analyzing these voices, much additional information such as health, psychology, and situation of people can be extracted and judged. In this study, we examined the parameters which can evaluate the credit worthiness of people through voice analysis. In this paper, we have obtained the parameters necessary for credit evaluation through voice analysis of those who are directly involved in the loan in relation to credit and reliability. In order to evaluate the credit rating, the pitches of the voices of a person who had no abnormality of credit and the person who had a problem of credit were analyzed and an experiment was carried out to quantify the difference in the voices of two kinds of people. The results of the pitch analysis
showed that the voice changes and differences before and after the bankruptcy was parameterized according to change rate of the pitch and the pitch dispersion in the voice of speaker’s independence and subordinate analyses. Therefore, it is possible to evaluate credit by extracting credit parameters through voice analysis, although it is problematic to evaluate all credits by voice.

References


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