

# An Analysis for the Male Villain's voice using a Speech Signal Processing

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## **Article Info**

**Volume 83**

**Page Number: 3887 - 3892**

**Publication Issue:**

**March - April 2020**

## **Abstract:**

Radio Drama is a genre of radio broadcasting that expresses dialogue, music, and sound effects only with sound based on the story, to entertain and impress listeners. Radio dramas are more difficult to convey the scenes and situations of drama as there is no video area than TV dramas, so the emphasis is on the sound realism. In particular, radio dramas should express their personality according to the characters only by voice, so they should be more careful in casting. This paper studied the male villain's voice as the first step in preparing vocal data for the casting of radio drama characters. The role of the male villain can be divided into two categories. One type of male villain is a male villain character who is large, muscular, rough and wild. Another male villain is a male villain character who is slim and fragile but shrewd, obscure and cunning. The characteristics of two male villain's voices were compared and analyzed based on sound signal processing principles. Starting from this paper, we will analyze the voices of the basic models of various characters for the future radio drama casting and accumulate data to prepare the foundation for the completion of the casting program.

## **Article History**

**Article Received:** 24 July 2019

**Revised:** 12 September 2019

**Accepted:** 15 February 2020

**Publication:** 23 March 2020

**Keywords:** Radio drama, story, Character, Vocal base data, Male villain, Sound signal processing

## **Introduction**

In the early 1920s, broadcasters using radio media began to launch, starting KDKA broadcasting in the United States. In 1927, South Korea under the Japanese colonial rule, radio stations were launched under the JODK call sign. Radio broadcasting is a sound broadcasting that broadcasts only by sound because it started based on the principle that sound can be moved farther by radio waves. In the early days of broadcasting, radio broadcasts were performed only by sound, so no special programs were planned. At that time, radio broadcasts were mainly about debates, talks, news, weather forecasts, information transfers, and songs. At the beginning of the radio, the listeners were just curious and curious about the voices of people coming out of small

boxes. Some people had been a peek into small radio box, and they even look and even try to open it. But for a while, people's minds soon started to demand more interesting broadcasts. So the program finally planned is Radio Drama. In Korea, radio dramas began to be produced around 1930. Around 1950, the radio drama was produced in earnest despite the beginning of TV broadcasting. Despite the increase in TV penetration in the 1960s and 1970s, small broadcast stations from MBC and TBC also produced radio dramas and reached the peak of radio drama. After that, in the early 1980s, the color of TV broadcasts became more colorful, the TV drama series became popular, and eventually radio dramas began to lose their popularity. However, listeners fascinated by radio dramas continue to enjoy radio dramas even now. But

most of the younger generation these days don't even know there is a radio drama.[1][2] Eventually, many radio stations disappeared, but KBS is still broadcasting about 6 radio dramas. Radio dramas are sometimes referred to as sound broadcasting arts composed entirely of sounds. This is because radio dramas lead the story to dialogue, music and sound effects. Radio dramas turn stories into conversations, music, and sound effects. Among them, the dialogue that leads the story directly is the most important. The character setting of the characters acting as ambassadors in the radio drama and the roles of the voice actors acting the characters are very important. Of course, the play that contains the contents of the play is important, but the voice actor's role is very important because it is necessary to perform the dialogue to lead the radio drama. [3][6][7] Therefore, it is most important to select an actor who is suitable for the characters in the play. Such a process is called casting. In this paper, we first select an example of the male villain's voice from the characters in the radio drama and analyze the characteristics of the male villain to prepare a standard for casting the male villain's voice in the future. For the study of voice for casting male villain in radio dramas, the characteristics of male villain's voices were classified, and the voices corresponding to them were collected and analyzed using acoustic analysis tools. The voice analysis of the characters for the casting of the radio drama male villain will help the cast of the TV drama and the movie in the future. In addition, modeling voice data for each character makes it possible to develop a casting program through AI (artificial Intelligence). Once the casting program is complete, PD and director can cast the actors reasonably and accurately in the future. [8][9][10]

### A Study on Voices for Casting Male Villain Character in Radio Drama

In this paper, I will analyze the voice characteristics of male villain and prepare a standard when casting male villain character in a radio drama. The role of the male villain can be broadly divided into two categories. One is a villain with a large, muscular, rough and violent character. The other is a male villain with a slender, fragile but clever, obscene and insinuating character. Of course, there are seemingly gentle and good, but inherently villain people.[4][5] However, in radio dramas, characters are expressed only by voice, so most of the time, the villain and good role are expressed into voice characteristics. A voice actor may express both voices when the characters in the play pretend to be good and turn into villains. Nowadays, villain roles in TV and movies may set as people who seem to be gentle, good and sincere, that is, people with smart and good voice. Radio dramas, however, distinguish between evil and good roles by voice. Based on these voice characteristics, two voice characteristics of male villain were compared and analyzed based on sound signal processing principle.[6][11][12] In order to extract the voices of male villain's vices, we selected radio dramas in which the villains appeared and analyzed the voices of the characters in the villains. The radio drama for the study extracted the voices of two types of male villains from "The Tyrant of Our Time," which was broadcast on December 15, 1996. Among them, the voices of the rough and violent villain and the cunning and insinuating villain were separated. For the voice analysis of the extracted male villains, we used Adobe's Cool-Editor program. As the analysis method, time domain analysis, spectral analysis, and spectrogram analysis were performed to extract the reference data and to compare and analyze the voices of the two types of villains. In the environment for using the analysis tool, the sample rate was set to 8,000Hz for voice sample, mono for channel, and 16 bit for resolution. [13][14]

## 2.1 Time domain analysis

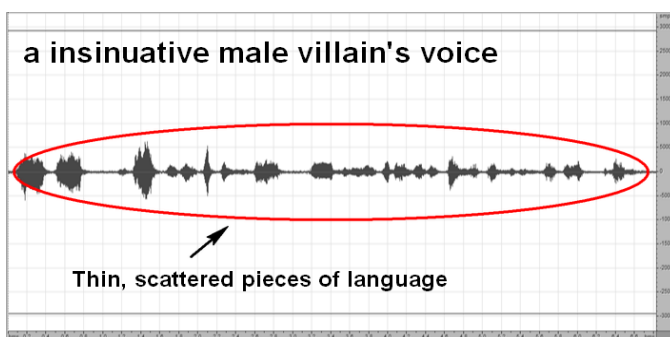
Time domain analysis can analyze the pronunciation of the basic voice rhythm, intonation and accents by examining the waveform of time. Analyzes to determine whether each voice of the two villain characters well represents the principle of the villain's vocalization, and that the parts that should be sounded strongly describe the parts that should be spoken strongly, long or short. In the time domain analysis, we compared the intensity and rhythm of the time zones by comparing the waveforms

$$E_t = 1/N \sum_{n=1}^N (E_r(n) - E_f(n))^2 \quad (1)$$

Equation (1) is a formula for obtaining energy in the time domain.



a. violent male villain's voice



b. Insinuating male villain's voice

Figure -1. Two types male villain's voice time domain waveform graph

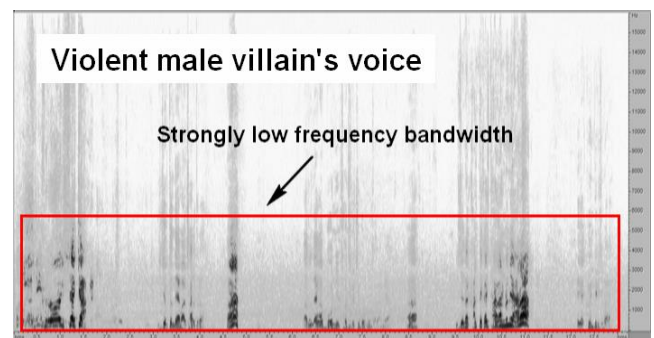
Looking at the time-domain graph of the violent male villain voice in Figure 1, it can be seen that the loud or snarling voice is strongly expressed. In the

time-domain graph of the violent male villain's voice, you can feel the violent voice of the male villain that the voice is roughly combined and then strongly expressed. b) The time domain graph of insinuating male villain's voice shows a thin and scattered graph. The small and dense graph shows the insinuating male voice.

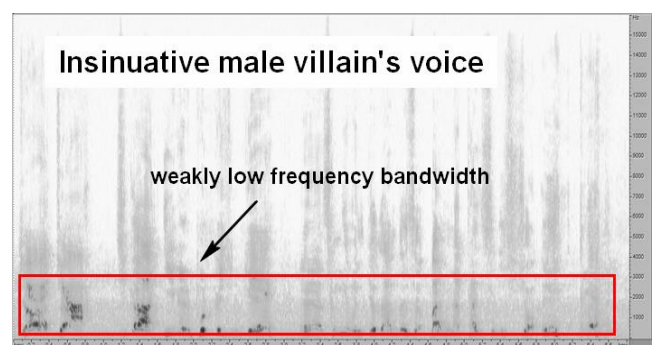
## 2.2 Spectrogram Analysis

Two types of male villain's voice spectrum analysis are performed by grasping the distribution of sound energy by frequency band of voice and comparing energy characteristics by frequency band. Spectrum analysis analyzes the difference of energy characteristics by frequency in order to analyze the difference of energy characteristics of two types male villain's voices. In the spectrogram analysis method, data  $E_1(n)$  obtained by digitally converting sound is called  $E_2(n)$ . The energy of each frequency component is measured by the following equation.

$$\text{Frequency\_energy} = \frac{1}{N} \left[ \sum_{n=1}^N (FE_1(n) - FE_2(n))^2 \right] \quad (2)$$



a. Violent male villain's voice



b. Insinuating male villain's voice

Figure – 2. Spectrogram graph of two types male villain's voice

According to the above equation, the difference of each frequency component is analyzed and sound energy is measured. Equation (2) is a formula for data-forming sound information of two types male villain's voice. The input sound is analyzed after the frequency conversion of the data as FE1(n) and the FFT conversion value of the sound as FE2(n). According to the above equation, two types male villain's voice were measured.

Figure 2 a) Spectrogram graph of a violent male villain's voice shows strong energy across the entire voice band below 6,000 Hz. The violent villain's voice has a strong energy distribution that acts as a threat to the listener. b) insinuating male villain's voice spectrogram graph shows that a) the energy is weakly distributed below 3,000 HZ compared to the spectrogram graph of the violent male villain voice. The reason why you use insinuating male villain's voice as a thin and weak voice is because you have to express your voice in a bad mood.

### 2.3 Spectral frequency analysis

Spectral analysis of voice compares sound pressure energy changes of two types of male villain's voices by frequency band. This analysis method is suitable for comparing sound components of voice because the sound pressure energy distribution of each frequency band can be confirmed. Spectral analysis shows how two types of male villain's voices are displayed in the voice frequency band and in which types of frequency bands they are compared with each other.

$$D_{LS} = \sqrt{\frac{1}{2\pi} \int_{-\pi}^{\pi} [10 \log_{10} \frac{P(\omega)}{\hat{P}(\omega)}]^2 d\omega} \quad (3)$$

$P(\omega)$  : Original signal,  $\hat{P}(\omega)$  : Made signal

Equation 3 above is a formula for measuring spectral difference using a log-spectral distance. Figure 3 compares the form-specific differences in

two types male villain's voice frequencies using a spectral frequency graph. First of all, the first form frequency below 1,000Hz is the low frequency band's vocalization frequency that uses the air volume of the lungs through the belly. violent male villain's voice frequency of The black line of Figure 3 graph shows a wider range and higher sound pressure level than the insinuating voice frequency. The second formant region, which is a frequency band of 1,000 Hz to 3,000 Hz, represents a change in voice due to a difference in vocal tracts. In the second formant band, the violent male villain's voice frequency is wider than the insinuating male villain's voice frequency band, and the sound pressure level is also high. The third formant band above 3,000 Hz also shows a high sound pressure level in the violent male villain's voice frequency range.

In general, the lower form of the first formant, the higher form of the third formant, and the middle form of the second formant show that the violent male villain's voice is higher than the insinuating male villain's voice whose voice frequency range and sound pressure level are similar.

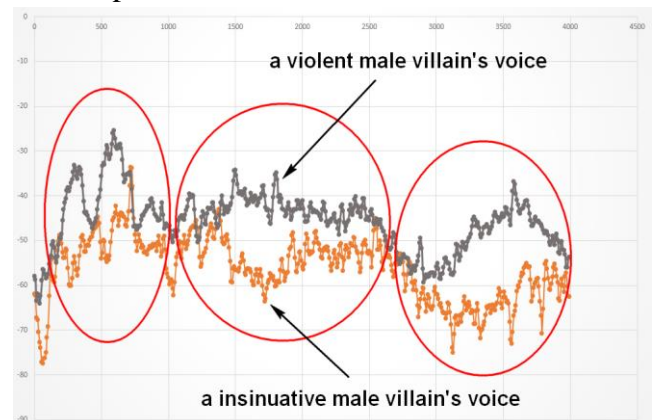


Figure-3 Two kinds of male villain voice

spectrum graph comparing

Table-1. Two types male villain's voice

frequency pitch data comparison table

For	violent voice						Insinuating
mant	pitch data						Voice Pitch Data



	fre quenc y (Hz)	Soun d level (dB)						fre quenc y (Hz)	Soun d level (dB)
1 Form ant	593 .75	- 25.4595 6039						718 .75	- 33.6805 6107
2F orma nt	1,8 04.68 7	- 34.8428 0777						2,5 54.68 7	- 45.2399 1776
3F orma nt	3,5 85.93 7	- 37.4602 6993						3,6 71.87 5	- 55.1596 2219

As a result, in order to casting a violent male villain, the wider the voice frequency band and the higher the sound pressure level, the better the casting can be. The frequency band that satisfies the violent male villain's character has a high sound pressure level and is widely formed so that it can be suitable for violent male villain's casting. [7][8][9]The data recorded in Table 1 are frequency pitch data and sound pressure level data of two types male villain's voice. This accumulation of data is very necessary because it can be the source needed to complete the program for future casting. As shown in Table 1, the formant pitch frequency band of the violent male villain's voice data is located in a lower frequency band than the insinuate male villain's voice data pitch frequency band. The insinuate male villain's sound pressure level data is lower than the violent male villain's sound pressure level data corresponding to the pitch frequency of each formant. These data indicate that the violent male villain's voice is low and loud and coarse, and the insinuate male villain's voice is high and relatively thin and small. [10][11]

## Analysis Result

Two types male villain's voice comparison studies were conducted as a basic study to secure the database of the radio drama character casting program. The two types male villain are the violent male villain and the insinuate male villain. For male villain casting of the radio drama, he selects a piece of villain from the previously broadcast radio drama and obtains the voice sample of the villain and analyzes the sample data using Sound Editor, a voice analysis tool. Speech analysis methods using Cool Editor are time domain analysis, spectrogram analysis and spectral analysis. In the time domain analysis, we analyze the time-based speech waveforms of male villain's voices and analyze the intensity and distribution of speech in amplitude and waveform. Spectrum analysis analyzes the distribution of sound energy by frequency band of speech. Spectral analysis is a method of comparing sound pressure energy changes in each frequency band of speech components. [12][13][14]The overall voice analysis of the two types male villain through this analysis process is shown in Table 2 above. The violent male villain's voice forms a wide frequency band and a strong sound pressure level, and shows voice characteristics that are repeatedly expressed with strong energy as if they are roughly clustered over the entire band of 6,000 Hz or less voice band. On the other hand, insinuate male villain's voice shows sound pressure level energy only below 3,000Hz, and overall voice characteristics appear to be weak, thin and scattered.

Table-2. Two types of male villain's voice

analysis results table

Analysis Method	violent male villain	insinuate male villain
Time Domain	Rough and strong expression.	Thin and scattered graph

Spectrogram	Strong energy distribution over all voice bands below 6,000 Hz	Energy distribution scattered weakly in voice band below 3,000Hz
spectrum	Wide voice frequency band and high sound pressure level	Narrow voice frequency band and low sound pressure level

### Conclusions

In this paper, we studied the male villain's voice as the first step to prepare the vocal data for the casting of the radio drama character. We analyzed male villain's voices by comparing them with two types of voices, divided into violent voices and insinuating voices. The harsh and violent villains is relatively rich in low-frequency sound and has the voice quality of a large person with a large skeleton and muscular body. The sneaky and insinuating voice of the villain has a relatively high frequency band, which is characterized by the voice of a small, slender body with a slender body. As shown in the results, it is necessary to accumulate the harsh and violent voice characteristics data and the sneaky and insinuating voice characteristics data to be used as more casting data. We will accumulate data by analyzing the voices of various basic character models for character casting of radio dramas. This paper will be the foundation for the completion of casting program of radio drama in the future.

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