OTT Contents Recording and Identification in Mobile Platform

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ABSTRACT

As the consumption method of media content has shifted from existing broadcasting to OTT, many OTT-only content is being produced and distributed. To properly evaluate the value of content distributed in OTT, it is necessary to evaluate the rational audience rating of an independent third party, not an OTT service company. However, due to the nature of OTT services, it relies only on data from service providers. As a method for a third party to investigate the audience rating of the OTT service, the content being viewed by the user in the OTT terminal is captured through separate software, and the fingerprint of the content is compared with the content fingerprint database to identify and record. In this paper, this identification method is made possible by proposing a method to capture screen and audio in Android, which is a representative mobile OTT terminal. For representative OTT services, check whether screen and audio capture is possible and check limitations.

KEYWORDS

OTT, Audience Rating, Recording, Android

1 INTRODUCTION

Due to the pandemic and the personalization of individual media content consumption tendency, OTT is becoming a service that provides media content, and various OTT service companies are emerging around the world. OTT service companies such as Netflix and Wave are producing a lot of their own content, but they are also providing a lot of content from existing production companies. In the case of such content producers, they cannot access service information of OTT service companies, so they have no choice but to unilaterally receive important information in contracts such as ratings. Therefore, for a fair contract, it is necessary to verify audience rating information provided by an OTT service company from a third institution. To this end, in addition to the existing audience rating survey method, a new audience rating survey technology is required. In addition, unlike existing broadcasting ratings, OTT is viewed through various devices, so it is expected that the characteristics of these devices will be used to investigate viewing behavior that has been difficult to investigate. For example, it is expected that detection using artificial intelligence technology will be possible for scenes or products that viewers are interested in.

In this paper, we propose how these third parties capture screens and audio, which can be the underlying techniques for OTT viewing ratings investigation and confirm the capture potential. If screen and audio can be captured, each fingerprint of screen and audio can be extracted from here and searched in the fingerprint database to identify the content being viewed and record ratings. This paper focuses on OTT viewing record survey services for Android using the Android platform.

2 Android

In this study, a prototype of screen and audio capture software for OTT viewing record survey service was implemented based on the Android platform. Most OTT services support Android platforms, and Android's share in the domestic mobile market is 72.29%[2], which is very suitable for the purpose of this study.

3 Contents Recording

3.1 Implementation

The way to detect OTT execution on Android is to use the UsageStatsManager. UsageStatsManager can provide device usage history and statistics to obtain information about applications that have been executed within a certain period.

In this study, the UsageStatsManager was used to call queryUsageStats to detect whether the OTT service was executed or not as shown in Code 1. Two conditions are required to call the method. The AndroidManifest must be granted Manifest.permission.PACKAGE_USAGE_STATS permission, and the device must be unlocked.

```
WHILE
  READ UsageStats

  IF UsageStats.lastTimeUsed > 0 THEN
    IF len UsageStats > 0 THEN
      IF package name in first UsageStats is OTT THEN
        start capture
```

Code 1: OTT service detection via queryUsageStats call.

When the OTT service is confirmed to run, call the MediaProjection class for screen capture and recording. MediaProjection is an API that provides access to screen content and audio provided by Android. MediaProjection should always work in the Foreground Service. MediaProjection's VirtualDisplay is an invisible virtual screen on which the content of the current screen is drawn. As shown in Code 2, the virtual screen is saved

using MediaRecorder. There are two ways to record audio. The method of recording with a microphone using MediaRecorder and the method of using AudioPlaybackCapture of AudioRecord. The method using a microphone has a disadvantage in that surrounding sounds may be recorded together. AudioPlaybackCapture is a feature that allows you to capture audio played by other apps that run from Android 10 version onwards. In this study, two methods are used together to record audio. Code 3 uses AudioPlaybackCapture to store audio.

```
INIT MediaRecorder
  SET AudioSource
  SET VideoSource
  SET Frame
  SET Output Path
  CALL prepare()

INIT VirtualDisplay
  SET name
  SET width
  SET height
  SET dpi
  SET surface in MediaRecorder

CALL start() in MediaRecorder
WAIT 5s
CALL stop() in MediaRecorder
CALL reset() in MediaRecorder
CALL release() in MediaRecorder
```

Code 2: Code for capturing the screen

```
INIT AudioRecord
  SET AudioFormat
  SET AudioPlaybackCaptureConfig
  CALL startRecording()

SAVE Audio

CALL stop() in AudioRecord
CALL release() in AudioRecord
```

Code 3: Recording using AudioPlaybackCapture

3.2 Capture Test

In this study, it was tested with four OTTs: Netflix, TVING, wavve, and Disney+. The test was conducted in dramas and movies.

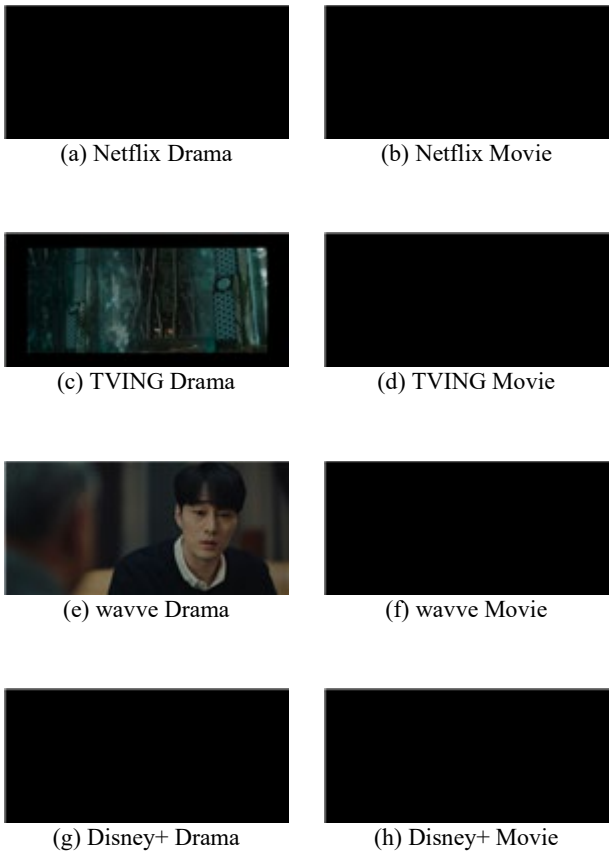
Table 1: Drama

OTT	Screen Capture	MIC	Media Recording
Netflix	X	O	X
TVING	O	O	O
wavve	O	O	O
Disney+	X	O	O

Table 2: Movie

OTT	Screen Capture	MIC	Media Recording
Netflix	X	O	X
TVING	X	O	O
wavve	X	O	O
Disney+	X	O	O

Unlike Netflix and Disney+, which have DRM applied to all contents, DRM was applied differently for each content in the case of TVing and Wave.



(a) Netflix Drama (b) Netflix Movie

(c) TVING Drama (d) TVING Movie

(e) wavve Drama (f) wavve Movie

(g) Disney+ Drama (h) Disney+ Movie

Figure 1: OTT Screen Capture

3.3 Analyze the cause of the capture failure

Android has a DRM called Widevine. Widevine is divided into three levels: L1, L2, and L3. Currently, most OTTs have widevine L1 levels. Currently, screen capture is not possible for OTT with Widevine L1 level applied. For Widevine L3 levels, vulnerabilities have been announced. For example, Netflix limits maximum image quality to SD at relatively weak L3 levels and allows playback to HD quality only at L1 levels. Screen capture is possible at the L3 level.

In the case of media recording, AudioPlaybackCapture can be set to prevent other services from reading audio. If not set separately, the default setting is applied according to the targetSdkVersion of the service. Services targeting Android 9 and below are not capable of audio capture, and services targeting Android 10 and above are set to support audio capture by default unless the settings are changed. According to Tables 3, all OTTs tested have a target version of Android 10 or higher. Therefore, audio capture should be possible if the settings have not been changed separately by the service. According to Tables 1 and 2, audio capture is not possible for Netflix, where the audio capture setting is disabled for Netflix.

Table 3: OTT SDK Version

OTT	min	target
Netflix	24	31
TVING	23	30
wavve	26	31
Disney+	21	31

4 Contents Identification

To investigate OTT audience ratings, which is the purpose of this study, a process of identifying what the content is using captured screens and audio information is necessary. The DNA of the content is extracted using the screen and audio, and the content is identified by comparing it with the server's DNA database.

Currently, screen capture of most OTT services is not possible, so the screen is used as an auxiliary and DNA is extracted using PCM data, which is audio data, as a focus. The PCM data used to extract DNA consists of 22 KHz, MONO, and 16 bits and is about 3.3 seconds long. DNA extraction works on Android by linking code implemented in C with JNI.

5 CONCLUSIONS

Due to the rapid growth of OTT services, not only existing broadcasting contents but also many OTT-only contents are being produced and distributed. To evaluate the legitimate value of such content, a reasonable evaluation of the audience rating is required, but due to the nature of the OTT service, it relies only on the data of the service provider. In this paper, we propose a method to capture screen and audio in Android as a method for a third party to investigate the audience rating of OTT services, and check whether capture is possible for each service and check its limitations. The captured screen and audio may be compared with the fingerprint database to identify content and provide it to the viewer rating survey.

In the future, by adding other mobile devices and capture hardware, we plan to study a capture method that can disable DRM, etc. This requires additional hardware but considering that hardware was also used in the existing viewership survey method, this would not be a big problem.

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