October 2022

Voicemail Information Encoding for Better Call Direction

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Introduction

Traditionally, an outbound voicemail prompt (e.g., a recording that plays when a user's voicemail is reached) may be an automated default prompt (e.g., a default recording provided by a wireless service provider) or may be a custom recording of a user of the voicemail. As either type of outbound voicemail prompt typically includes a recording of a human voice, it is difficult, or sometimes impossible, for automated message delivery services (for example, for messages like "your prescription is ready", or "make sure to vote for XXX on Tuesday") to reliably determine whether incoming audio data is from a live human answering the phone or from an outbound voicemail prompt that includes a recording of a human voice.

Generally, voicemail inboxes only start to record inbound messages after playing an outbound voicemail prompt. However, due to the difficulty of classifying audio data, automated phone message delivery services frequently mistake the outbound voicemail prompt as a live human response and begin to provide an inbound automated message while the outbound voicemail prompt is still playing. In turn, this causes a portion of or the entirety of the inbound automated message to be left out of the voicemail recording.

Furthermore, without being able to confirm whether incoming audio data is from a live human or from a recording of a human voice, automated message delivery services may inadvertently provide inbound messages containing sensitive information to voicemail inboxes rather than the live human users for which they are intended, thus increasing the risk that sensitive information is misappropriated (e.g., medical data, two-factor authentication passcodes, etc.). Accordingly, embodiments of the present disclosure propose encoding information within outbound voicemail prompts with computer-readable signatures, metadata, etc. to allow for users

and computing systems to distinguish between a live human or an outbound voicemail prompt and act accordingly.

Summary

Computer-implemented systems and methods for tagging outbound voicemail prompts with a computer-readable signature allows for more efficient voicemail usage and enhanced voicemail privacy. In one embodiment, a computing device can encode at least a portion of an outbound voicemail prompt with a computer-readable signature. For example, a beginning portion of the outbound voicemail prompt may be encoded with imperceptible or barely-perceptible audio data that identifies the outbound voicemail prompt as a recording, rather than a live human user. For another example, outbound audio data including the computer-readable signature can be provided before the outbound voicemail prompt . Upon receiving the computer-readable signature, a computing device for an automated message delivery service can identify the outbound audio data as being a voicemail message and may proceed accordingly.

In some embodiments, the computer-readable signature can include Dual Tone Multi Frequency (DTMF) tones. The DTMF tones may be placed at the beginning of the outbound voicemail prompt. In this manner, when a person or computing system is sent to the voicemail of the device, the computer-readable signature is played before the outbound voicemail prompt to indicate to the person or computing system that the incoming audio data is a recording, rather than a live human user.

Additionally, or alternatively, in some embodiments, the computing system can encode an end portion of an outbound voicemail prompt with the computer-readable signature. For example, in some embodiments, if the computing device receives an inbound automated message

and the inbound automated message is sent to the voicemail, the end portion of the outbound voicemail prompt in which the computer-readable signature is encoded may be provided to the caller (e.g., an automated message delivery service, etc.) after the outbound voicemail prompt has finished playing. For example, the computing device may utilize DTMF tones to create the computer-readable signature and place it after the end of the outbound voicemail prompt. In this manner, when a person or computing system is sent to the voicemail of the device, the signature is played at the end of the outbound voicemail prompt, indicating to the person or computing system the outbound voicemail prompt has ended and that the voicemail has begun recording. Alternatively, in some implementations, the computing device may encode an end portion of the outbound voicemail prompt with a computer-readable signature that includes imperceptible or barely-perceptible audio data indicating a time remaining for the outbound voicemail prompt so that an automated message delivery service can determine when to begin providing an inbound automated message. For example, with ten seconds remaining in the outbound voicemail prompt, the computing device may encode one second of the outbound voicemail prompt with audio data indicating that nine seconds remain in the outbound voicemail prompt.

Similarly, in some embodiments, the computing device may encode the beginning of the outbound voicemail prompt with a computer-readable signature that indicates that an outbound voicemail prompt is playing and that the prompt will continue to play for a certain amount of time. In this manner, a computing system for an automated message delivery service may be able to determine that an outbound voicemail prompt is currently being played and when to begin to transmit an inbound automated message.

A computer-readable signature used to tag an outbound voicemail prompt may be one of infinitely many data schemes. For example, the computing device may use DTMF tones to

generate the computer-readable signature and append the computer-readable signature to the beginning or the end of the outbound voicemail prompt. In another example, the computing device may generate a custom outbound voicemail prompt for the voicemail and may upload the custom outbound voicemail prompt to a secure database which may be queried by computing systems based on an identifier of the computing device. For example, the database may be queried based on a phone number associated with the computing device to determine a beginning and an end of the custom outbound voicemail prompt. Still further, in another example, metadata may be sent from the computing device to a calling device indicating that the calling device has reached the voicemail, and further metadata may be sent from the computing device to the calling device indicating the outbound voicemail prompt has ended. It should be appreciated that the embodiments described for a computer-readable signature are for descriptive purposes only. In practice, any data structure, encoding scheme, etc. may be used to indicate a beginning or an end of an outbound voicemail prompt.

In one embodiment, a computing device sending or receiving a computer-readable signature associated with an outbound voicemail prompt may notify a user via various data channel(s). For example, when a computing device provides a computer-readable signature to a caller via the outbound voicemail prompt, it may notify the user via a device feature (e.g., banner, buzz, haptic feedback, tone, etc.) of the computing device that a caller (e.g., an automated message delivery service, etc.) is providing an inbound message. For example, a user computing device may append the computer-readable signature to the beginning of an outbound voicemail prompt, and may initiate playback of the outbound voicemail prompt in response to a call received by the user computing device. Once the computer-readable signature is provided, the user computing device can indicate to the user that the computer-readable signature has been

provided (e.g., generating a notification for the user that indicates the computer-readable signature has been provided, etc.).

Similarly, a computing device that has received a computer-readable signature may notify a user that they have reached a voicemail via a device feature. For example, a user computing device may receive an instruction from a user to place a call. The call may go to voicemail, and the voicemail may provide a computer-readable signature alongside an outbound voicemail prompt (e.g., encoded within the prompt, appended before the prompt, etc.). The user computing device can then provide a notification to the user that is descriptive of the computer-readable signature.

In one embodiment, the computing device may communicate with a plurality of devices associated with the computing device to provide a notification that a computer-readable signature has been sent or received. For example, a computing device may receive a call that is sent to voicemail and, in response, provide the computer-readable signature to the caller. The computing device may then instruct device(s) (e.g., a smart TV, a wireless speaker, etc.) connected to the same network as the computing device to provide a notification via a device feature that a caller has reached the voicemail of the computing device.

In one embodiment, the computing device may record a caller's audio immediately after sending a computer-readable signature and perform pattern recognition on the recorded audio to optimize voicemail usage and call frequency. The computing device may input the recorded audio to a machine-learned model and compare the output against a database of known deceptive messages. The computing device may then end the call or block the calling number. For example, a call may be sent to voicemail on a computing device and the computing device may send a computer-readable signature when an outbound voicemail prompt begins. The user

computing device may then immediately begin recording the inbound message and determine that the caller is a spam caller (e.g., a message pertaining to a car's extended warranty is being played) and then end the call and block the calling number.

In some embodiments, a computer-readable signature can be generated on the computing device and the signature can be provided to a calling computing system to notify the calling computing system that it has reached a voicemail. The calling computing system may then delay playing its message (e.g., a pre-recorded message, a machine-generated message, etc.). The user computing device may send the computer-readable signature to the calling computing system again once the outbound voicemail prompt has completed. Upon receiving the computer-readable signature again, the calling computing system may begin to provide an inbound automated message for the voicemail. It should be appreciated that the methods and systems disclosed herein are for descriptive purposes only. In practice, computer-readable signatures for identifying voicemail beginnings or ends may be performed by any device which sends or receives phone calls. Further, methods and systems described for determining deceptive messages are for descriptive purposes only, and any systems or devices may perform some or all of the steps in receiving, determining, and handling deceptive messages.

Detailed Description

Figure 1 depicts an example computing system 100 in which systems and methods in accordance with the present disclosure can be executed upon. The computing system comprises a computing device 102 containing one or more processors 112, memory 114 which may contain data 116 and instructions 118 configured to carry out the methods disclosed herein, and a user input component 122. The user input component can be, for example, a touch display or physical

buttons within the user computing device 102. The computing system 100 further comprises a network 180 and a caller computing system 124. The caller computing system 124 comprises one or more processors 126, and memory 128 which may contain data 130 and instruction 132 configured to carry out the methods disclosed herein. In one embodiment, the computing device 102 may receive a phone call via network 134 from the caller computing system 124. The phone call may be directed to the computing device's 102 voicemail. The user computing device 102 may provide a computer-readable signature to the caller computing system 124 via network 134 to notify the caller computing system 124 that it has reached the voicemail of the computing device 102 (e.g., via an encoded outbound voicemail prompt). To provide the computer-readable signature, the computing device 102 may encode an outbound voicemail prompt with the computer-readable signature and initiate playback of the outbound voicemail prompt, or may provide the computer-readable signature before, during (e.g., pausing playback to provide the computer-readable signature, causing playback of the computer-readable signature concurrently with playback of the outbound voicemail prompt, etc.), or after playback of the outbound voicemail prompt . Upon receiving the computer-readable signature, the caller computing system 124 may provide an inbound automated message for recording, or may instead terminate the call.

For example, a doctor's office may utilize the calling system 124 to provide automated messages to patients. The computing device 102 may be a device associated with a patient of the doctor's office. The calling system 124 may call the computing device 102 and be sent to the voicemail of the computing device 102. The calling system 124 can receive a computer-readable signature from the user computing device 102 (e.g.,via an encoded outbound voicemail prompt, etc.). The caller computing system 124 may terminate the call or alter any automated message it

is configured to provide to avoid leaving sensitive information on the voicemail of the computing device 102.

In some instances, the computing device 102 may send a computer-readable signature to the caller computing system 124 at the end of an outbound voicemail prompt to signify the end of the outbound voicemail prompt and the beginning of a recording session. For example, the caller computing system may place a call to the computing device 102 and the call is sent to the voicemail of the computing device 102. The computing device may send a computer-readable signature to the caller computing system 124 at the end of the outbound voicemail prompt and begin recording for an inbound message. Upon receiving the signature, the caller computing system 124 may provide an automated message for recording at the computing device 102 as the caller computing system 124 can determine that the voicemail has begun recording.

It should be appreciated that the methods described herein may be provided alone, simultaneously, or together at separate times. For example, the computing device may provide a computer-readable signature both at the beginning of an outbound voicemail prompt as well as the end of an outbound voicemail prompt. In this manner, the caller computing system 124 may be notified of when or if it has reached a voicemail as well as when the outbound voicemail prompt is complete and the voicemail has begun recording.

Figure 2 depicts an example computing system 200 in which systems and methods in accordance with the present disclosure can be executed upon. The computing system 200 comprises a computing device 202 containing processor(s) 212, memory 214 which may further contain data 216 and instructions 218, machine-learned model(s) 220, and a user input component 222. The user input component may be, for example, physical buttons, touch display, or some other interactable device. The computing system 200 further includes a network 280 as

well as a caller computing system 250 containing processor(s) 252 and memory 254 which may further contain data 256 and instructions 258. The computing system 200 may further include a server computing system 230 comprising processor(s) 232, memory 234 which may contain data 236 and instructions 238, and machine-learned model(s) 240. In one embodiment, the caller computing system may provide a phone number associated with the computing device's 202 to the server computing system 230 via network 280 to determine a computer-readable signature of the computing device's 202 voicemail. The caller computing system 250 may place a phone call to the computing device 202 and wait to receive an outbound voicemail prompt that includes audio data from the computing device 202. The audio data received from the computing device 202 may be analyzed by the caller computing system 250 against the computer-readable signature received from the server computing system 230 to determine if the phone call went to voicemail.

In one embodiment, upon receiving a phone call from the caller computing system 250, the computing device 202 may send the phone call to its voicemail and input any inbound message received from the caller computing system 250 to the machine-learned model(s) 220. The machine learned model(s) 220 may determine whether the caller computing system 250 is a malicious caller based on the inbound message and respond accordingly. In one particular embodiment, the inbound message received from the caller computing system 250 is sent to the server computing system via network 280 and the machine-learned model(s) 240 are used to determine whether the caller computing system 250 is a malicious or wanton caller.

In some instances, the computing device 202 may upload an outbound voicemail prompt for its voicemail to the server computing system 230. The outbound voicemail prompt may be uploaded manually by a user or may be uploaded to the server computing system 230

automatically by the computing device 202 each time the outbound voicemail prompt is created, edited, or deleted. The caller computing system 250 may then look up the computing device's 202 outbound voicemail prompt via the server computing system 230 to identify when it has reached the computing device's 202 voicemail.

Additionally, or alternatively, in some implementations, provision of an outbound voicemail prompt may be indicated to a user via a display device of the user computing device 202 (e.g., a smartphone display, a television display communicatively coupled to the user computing device 202, etc.). For example, the user computing device 202 can receive a call from the caller computing system 250. As the call is received, the user computing device 202 may provide a notification via the display device that indicates to a user of the user computing device 202 that the caller computing system 250 is currently calling the user.

If the user does not accept the call, the user computing device 202 can initiate voicemail services after a certain amount of time has passed and provide an outbound voicemail prompt. The user computing device 202 can provide a notification to the user that indicates that the user computing device 202 is currently providing the outbound voicemail prompt (e.g., a notification that says "currently playing voicemail recording to caller"). Additionally, as the user computing device 202 provides the computer-readable signature to the caller computing system 250, the user computing device 202 can provide a notification to the user that the computer-readable signature has been provided (e.g., a notification that says "voicemail identifier provided to automated message delivery system").

Once the outbound voicemail prompt is completed, the user computing device 202 can initiate recording to record any message the caller computing system 250 may leave. If the user computing device determines that the caller computing system 250 is providing audio data in the

form of a voicemail message, the user computing device 202 can provide a notification to the user that indicates that the user computing device 202 is currently recording a message from the caller computing system 250. In such fashion, the user computing device 202 can provide real-time notifications to a user that informs the user as to the status of the voicemail service.

It should be appreciated that the methods and the systems described to execute the methods are for descriptive purposes only. In practice, the methods described herein may be performed on any number of computing systems such as, for example, the methods described with respect to FIG. 1 may be performed or executed on the computing systems of FIG. 2 and vice versa.

Figures

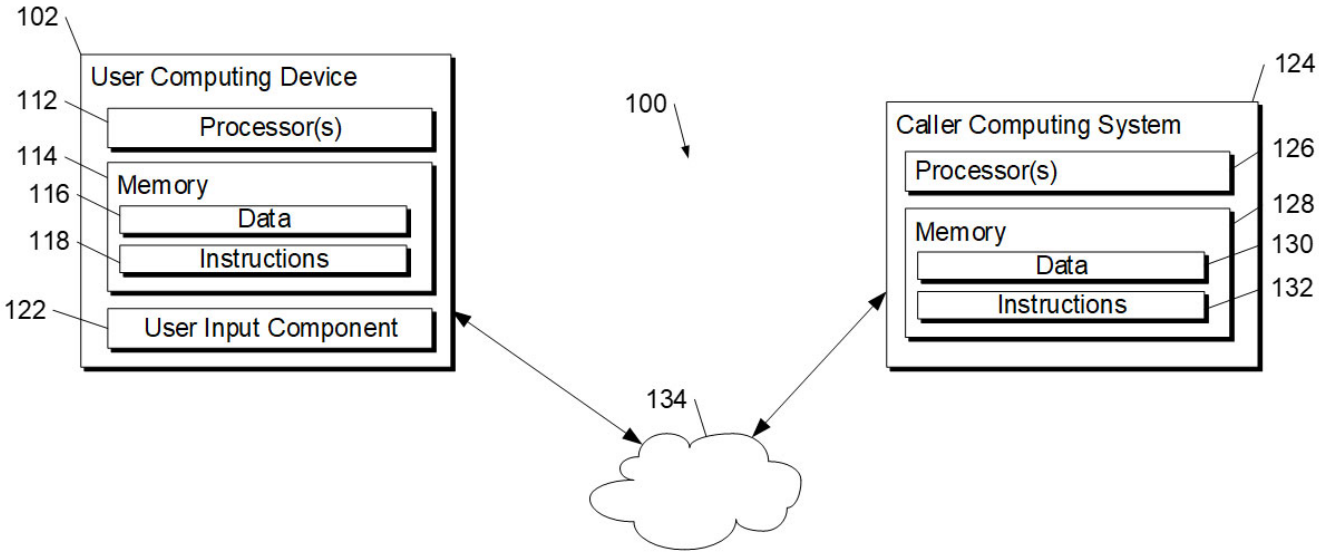

FIG. 1

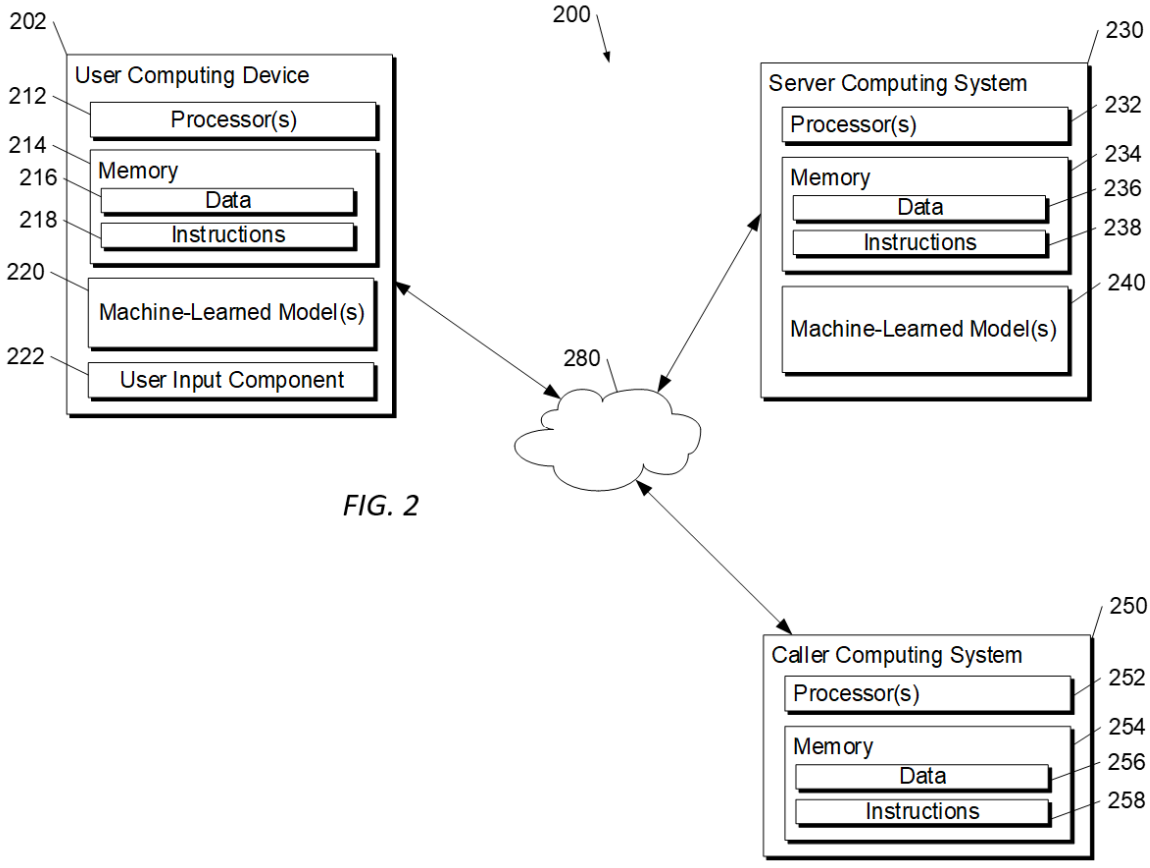

FIG. 2

Abstract

The present disclosure describes computer-implemented systems and methods for encoding information to outbound voicemail prompts with a computer-readable signature allowing for more efficient voicemail usage and enhanced voicemail privacy. In one embodiment, a computer readable signature is provided at the beginning of an outbound voicemail prompt to signify to a calling computing system it has reached the voicemail, and a computer readable signature is provided at the end of the outbound voicemail prompt to signify to the calling computing system that the outbound voicemail prompt has ended and the voicemail is recording.