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Using Variation in Audio to Convey Change in Data

ABSTRACT

In devices such as smart speakers or other headless devices that lack a display screen, or when an audio user interface is used, it is not possible for the user to view data graphically. It is therefore difficult for such user interfaces to convey statistical data or trends. This disclosure describes techniques to map data to audio signals. A change in data is reflected as a change in some property, e.g., pitch, amplitude, etc., of the audio signal. Per the techniques, a user hears trends in data, e.g., data is auditorily visualized, referred to herein as audiolized.

KEYWORDS

- Data visualization
- Audiolization
- Audio pitch
- Audio UI
- Smart speaker
- Headless device
- Screen reader

BACKGROUND

Graphical user interfaces are designed to include visual highlighting, e.g., different shapes, sizes, colors, shading, etc. for trends or important data points in a diagram or chart. However, in devices such as smart speakers or other headless devices that lack a display screen, or when an audio user interface is used, it is not possible for the user to view data graphically. It is therefore difficult for such user interfaces to convey statistical data or trends.

DESCRIPTION

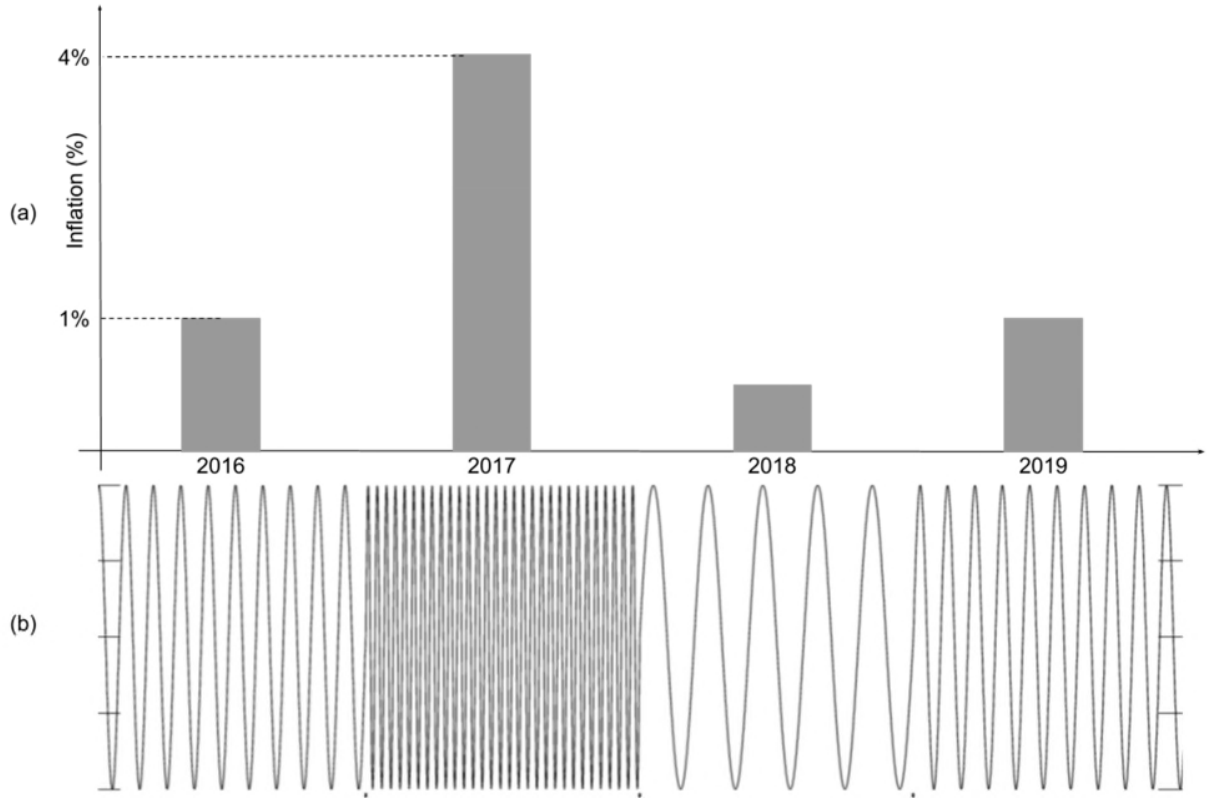

Fig. 1: Using variation in audio to convey change in data

Fig. 1 illustrates an example of using changes in properties of audio signals to convey change in data, per the techniques of this disclosure. A screen-free device, e.g., a smart speaker, a wearable device, or a device that is being used in audio mode (e.g., a smartphone while it is in a user's pocket) is to provide a read out of inflation data to the user. Fig. 1(b) illustrates the pitch of the voice used to read out the data. As illustrated in Fig. 1(a), the data values are different in different years with a peak in 2017 (4%) and a trough in 2018 (0.5%).

Per techniques of this disclosure, a property of the audio, e.g., the pitch, is varied based on the size (amplitude) of the data, as illustrated in Fig. 1(b). The change in this audio property enables the user to auditorily visualize ("audiolize") trends in the data. For example, a smart

speaker that provides a readout of this data announces that “inflation was 1% in 2016” at a certain initial pitch; then “inflation was 4% in 2017” at a pitch two octaves higher; then “inflation was 0.5% in 2018” at a pitch that is half octave below the initial pitch; and announce that “inflation was 1.3% in 2019” at a pitch slightly higher than the initial pitch.

While Fig. 1(b) illustrates a slight change in pitch based on the data value, the smart speaker can also be configured to vary other properties, e.g., voice used to provide the readout, speed of the readout, accent, volume level, etc. Further, the smart speaker can also be configured to only emphasize extreme changes, e.g., year 2018, while using a constant pitch for the other years. User interface designers can specify the properties of the audio that are to be changed with the data, the extent to which the properties are changed, and threshold changes in data that trigger changes in the audio properties.

For example, low-amplitude data can be announced in baritone, or male pitch, while higher amplitude data can be announced in soprano, or female pitch. Other options can include announcing low-amplitude data in a human voice and higher amplitude data in a robotic voice; announcing low-amplitude data using a low speaker volume and announcing higher amplitude data using a high speaker volume; etc. Other audio properties, e.g., intonation, spectral purity or width, etc., can also be used to signal trends in data.

Aside from audio representation of data, the described techniques can also be applied to indicate or notify the status of an event or a module. For example, the lack of a secure internet connection for the device can be announced in an urgent tone. In another example, an improvement in traffic conditions can be announced in reassuring tones.

In this manner, the techniques of this disclosure provide audio user interfaces that enable a user to gain an intuitive, auditory understanding of numeric data. Per the techniques, changes in data can easily be auditorily perceived by the user.

CONCLUSION

In devices such as smart speakers or other headless devices that lack a display screen, or when an audio user interface is used, it is not possible for the user to view data graphically. It is therefore difficult for such user interfaces to convey statistical data or trends. This disclosure describes techniques to map data to audio signals. A change in data is reflected as a change in some property, e.g., pitch, amplitude, etc., of the audio signal. Per the techniques, a user hears trends in data, e.g., data is auditorily visualized, referred to herein as audiolized.