INTERACTION USING TOUCH AND NON-TOUCH GESTURES

FIELD OF ART

The features described herein generally relate to techniques for optimizing user interaction with a computing device using gestures.

BACKGROUND

Man-machine interfaces have been around since the earliest machines. For early computers, the interface involved a display monitor (e.g., a cathode ray tube—CRT) for providing information to the user, and a textual keyboard for the user to provide input to the computer. Over the years, changes and improvements have been made to simplify this interface. The mouse input device and graphical user interface have made computers much more easy to use, and have become ubiquitous among computers.

Another type of input device has been the electromagnetic tablet, which included a flat surface, under which was an array of antennas that could detect the presence of an electromagnetic pen. As a further improvement on those early tablets, modern tablets have incorporated a display with the tablet's flat surface, so that the computer's display monitor can detect the presence of an electromagnetic pen. Even further improvements have done away with the requirement for the electromagnetic pen, and have become sensitive to the touch of any physical object, such as the user's finger.

All of these advancements and improvements illustrate the general need for simplifying computer-user interfaces, to make computing even easier than before.

SUMMARY

This summary is not intended to identify critical or essential features of the inventions claimed herein, but instead merely summarizes certain features and variations thereof.

A computer interface system may use both touch gestures and non-touch gestures, and may include different gesture detection systems optimized for detecting touch and non-touch gestures. The system may allow these different gesture detection systems to view or otherwise detect a user's gesture and interpret it as an identified gesture. The detection systems may also generate similarity values indicating the relative strengths of the match between their captured images and a predefined template for the identified gesture, and compare these values with predetermined thresholds to arrive at the gesture identification.

In some embodiments, the similarity values for both systems may be compared against thresholds, which may also vary depending on system type, gesture type, context, and other factors, to combine touch and non-touch detection results and ultimately select an inputted gesture.

The touch-based gesture detection system and non-touch based gesture detection system need not be limited to a particular type of gesture. For example, the touch-based gesture detection system may also attempt to detect non-touch gestures, and vice versa.

The combining process may account for relative weightings of the detection systems' gesture identification, and may use a differential threshold to determine which system's gesture identification should be adopted.

Other details and features will also be described in the sections that follow.

BRIEF DESCRIPTION OF THE DRAWINGS

Some features herein are illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings and in which like reference numerals refer to similar elements.

FIG. **1** illustrates an example of a basic computing system on which the features herein may be implemented.

FIG. **2** illustrates an example gesture input system usable with the computing system of FIG. **1**.

FIG. **3** illustrates examples of non-touch and touch gestures that may be detected using the systems shown in FIGS. **1** and **2**.

FIGS. **4***a* and **4***b* illustrate an example application that combines touch and non-touch gestures.

FIG. **5** illustrates an example process of detecting a touch gesture.

FIG. **6** illustrates an example process allowing use of touch and non-touch gestures.

FIG. **7** illustrates an example process of detecting touch and non-touch gestures.

DETAILED DESCRIPTION

FIG. **1** illustrates, in one aspect described herein, basic components of an example computing system on which features described herein may be implemented. The system **100** may take the form of a general purpose computer, such as a personal computer. System **100** may be implemented as any other fixed or mobile electronic device, such as a mobile cellular telephone, mobile communication device, personal data assistant (PDA), pager, TV device, music player, AM/FM/digital radio receiver, video player, camera, etc.

The system **100** may have one or more processors **101**, such as a programmable logic device or multi-purpose microprocessor, that may execute computer-executable instructions to provide features described herein. The instructions may be stored as computer-readable instructions on one or more computer-readable media, such as memory devices **102**, which may be dynamic and/or static random access memories (RAM), read-only memories (ROM), magnetic or optical disk, or any other desired computer-readable storage device. The system **100** may also include one or more removable media **103** that can also store any of the data described herein (e.g., computer-readable instructions, data described below, etc.). The removable media **103** may be any desired type, such as removable FLASH memory, disk drives, optical or magnetic disks, etc.

[**21**] The system **100** may include one or more output devices to provide information and feedback to the user. The output devices may include video output devices, such as a display **104**, which can display menu choices, interactive displays, video, or any other visible information to the user. The output devices may also include one or more speakers **105**, which can be used to play audio for the user.

The system **100** may also include one or more user input devices **106**. The user input devices **106** may be, for example, alphanumeric push buttons on a keyboard (e.g., desktop computer keyboard, mobile telephone keypad, etc.), touch and/or capacitive-sensitive pads on a laptop, computer mouse, trackball, stylus on a sensitive input area or display, etc. As will be described below, the system may use one or more cameras **107** to provide visual input to the processor. The system **100** is illustrated as an integral system, but may be separated into various distinct components as desired.

FIG. **2** illustrates an example gesture detection system **200** that may be used with the computing system **100**. The gesture