[0016] The interpreted data produced by the artificial neural network comprises the identification of at least one touch-based gesture, or a calculation of at least one numerical quantity whose value is responsive to the touch-based gesture made by the user.

[0017] In another aspect of the invention, the artificial neural network is able to distinguish among a plurality of gestures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] The above and other aspects, features and advantages of the present invention will become more apparent upon consideration of the following description of preferred embodiments taken in conjunction with the accompanying drawing figures.

[0019] FIGS. **1***a*-**1***g* depict a number of arrangements and embodiments employing the HDTP technology.

[0020] FIGS. **2***a*-**2***e* and FIGS. **3***a*-**3***b* depict various integrations of an HDTP into the back of a conventional computer mouse as taught in U.S. Pat. No. 7,557,797 and in pending U.S. patent application Ser. No. 12/619,678.

[0021] FIG. **4** illustrates the side view of a finger lightly touching the surface of a tactile sensor array.

[0022] FIG. **5***a* is a graphical representation of a tactile image produced by contact of a human finger on a tactile sensor array. FIG. **5***b* provides a graphical representation of a tactile image produced by contact with multiple human fingers on a tactile sensor array.

[0023] FIG. **6** depicts a signal flow in an HDTP implementation.

[0024] FIG. **7** depicts a pressure sensor array arrangement.

[0025] FIG. **8** depicts a popularly accepted view of a typical cell phone or PDA capacitive proximity sensor implementation.

[0026] FIG. **9** depicts an implementation of a multiplexed LED array acting as a reflective optical proximity sensing array.

[0027] FIGS. **10***a*-**10***c* depict camera implementations for direct viewing of at least portions of the human hand, wherein the camera image array is employed as an HDTP tactile sensor array.

[0028] FIG. **11** depicts an embodiment of an arrangement comprising a video camera capturing the image of the contact of parts of the hand with a transparent or translucent surface.

[0029] FIGS. **12***a*-**12***b* depict an implementation of an arrangement comprising a video camera capturing the image of a deformable material whose image varies according to applied pressure.

[0030] FIG. **13** depicts an implementation of an optical or acoustic diffraction or absorption arrangement that can be used for contact or pressure sensing of tactile contact.

[0031] FIG. **14** shows a finger image wherein rather than a smooth gradient in pressure or proximity values there is radical variation due to non-uniformities in offset and scaling terms among the sensors.

[0032] FIG. **15** shows a sensor-by-sensor compensation arrangement.

[0033] FIG. **16** (adapted from http://labs.moto.com/diy-touchscreen-analysis/) depicts the comparative performance of a group of contemporary handheld devices wherein straight lines were entered using the surface of the respective touchscreens.

[0034] FIGS. **17***a*-**17***f* illustrate the six independently adjustable degrees of freedom of touch from a single finger that can be simultaneously measured by the HDTP technology.

[0035] FIG. **18** suggests general ways in which two or more of these independently adjustable degrees of freedom adjusted at once.

[0036] FIG. **19** demonstrates a few two-finger multi-touch postures and gestures from the many that can be readily recognized by HTDP technology.

[0037] FIG. **20** illustrates the pressure profiles for a number of example hand contacts with a pressure-sensor array.

[0038] FIG. **21** depicts one of a wide range of tactile sensor images that can be measured by using more of the human hand

[0039] FIGS. **22***a*-**22***c* depict various approaches to the handling of compound posture data images.

[0040] FIG. **23** illustrates correcting tilt coordinates with knowledge of the measured yaw angle, compensating for the expected tilt range variation as a function of measured yaw angle, and matching the user experience of tilt with a selected metaphor interpretation.

[0041] FIG. **24***a* depicts an embodiment wherein the raw tilt measurement is used to make corrections to the geometric center measurement under at least conditions of varying the tilt of the finger. FIG. **24***b* depicts an embodiment for yaw angle compensation in systems and situations wherein the yaw measurement is sufficiently affected by tilting of the finger.

[0042] FIG. **25** shows an arrangement wherein raw measurements of the six quantities of FIGS. **17***a*-**17***f*, together with multitouch parsing capabilities and shape recognition for distinguishing contact with various parts of the hand and the touchpad can be used to create a rich information flux of parameters, rates, and symbols.

[0043] FIG. **26** shows an approach for incorporating posture recognition, gesture recognition, state machines, and parsers to create an even richer human/machine tactile interface system capable of incorporating syntax and grammars.

[0044] FIGS. **27***a*-**27***d* depict operations acting on various parameters, rates, and symbols to produce other parameters, rates, and symbols, including operations such as sample/hold, interpretation, context, etc.

[0045] FIG. **28** depicts a user interface input arrangement incorporating one or more HDTPs that provides user interface input event and quantity routing.

[0046] FIGS. **29***a*-**29***c* depict methods for interfacing the HDTP with a browser.

[0047] FIG. **30***a* depicts a user-measurement training procedure wherein a user is prompted to touch the tactile sensor array in a number of different positions. FIG. **30***b* depicts additional postures for use in a measurement training procedure for embodiments or cases wherein a particular user does not provide sufficient variation in image shape the training. FIG. **30***c* depicts boundary-tracing trajectories for use in a measurement training procedure.

[0048] FIG. **31** depicts an HDTP signal flow chain for an HDTP realization implementing multi-touch, shape and constellation (compound shape) recognition, and other features.

[0049] FIG. **32** illustrates a portion of the architecture shown in FIG. **31** wherein an ANN stage is implemented after a parameter refinement stage for each parameter vector.

[0050] FIG. **33** depicts an alternate embodiment, an ANN can be provided for one or more individual parameters from