given patient. Because this hierarchy is trained using fully unsupervised machine learning, the hierarchy will change over time as knowledge is accrued. The combined effect of these independent predictors on likelihood of disease is greater than the sum of the individual effects. By way of example, in one embodiment, mammography finding of BIRAD IV increases the likelihood of a malignant biopsy result in the study population by five percent, while a Gail 5-year risk score >1.66% increases the likelihood of malignancy by 26%, yet together these findings increase the likelihood of disease by 42%—greater than the sum total of their individual effects.

[0161] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the root terms "include" and/or "have," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

[0162] The corresponding structures, materials, acts, and equivalents of all means plus function elements in the claims below are intended to include any structure, or material, for performing the function in combination with other claimed elements as specifically claimed. The description of the present invention has been presented for purposes of illustration and description, but is not intended to be exhaustive or limited to the invention in the form disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art without departing from the scope and spirit of the invention. The embodiment was chosen and described in order to best explain the principles of the invention and the practical application, and to enable others of ordinary skill in the art to understand the invention for various embodiments with various modifications as are suited to the particular use contemplated.

[0163] The invention can take the form of an entirely hardware embodiment or an embodiment containing both hardware and software elements. In at least one exemplary embodiment, the invention is implemented in a processor (or other computing device) loaded with software, which includes but is not limited to firmware, resident software, microcode, etc.

[0164] A representative hardware environment for practicing at least one embodiment of the invention is depicted in FIG. **28**. This schematic drawing illustrates a hardware configuration of an information handling/computer system in accordance with at least one embodiment of the invention. The system includes at least one processor or central processing unit (CPU) **10**. The CPUs **10** are interconnected via system bus **12** to various devices such as a random access memory (RAM) **14**, read-only memory (ROM) **16**, and an input/output (I/O) adapter **18**. The I/O adapter **18** can connect to peripheral devices, such as disk units **11** and tape drives **13**, or other program storage devices that are readable by the system. The system can read the inventive instructions on the program storage devices and follow these instructions to execute the methodology of at least one embodiment of the invention. The system further includes a user interface adapter **19** that connects a keyboard **15**, mouse **17**, speaker **24**, microphone **22**, and/or other user interface devices such as a touch screen device (not shown) to the bus **12** to gather user input. Additionally, a communication adapter **20** connects the bus **12** to a data processing network **25**, and a display adapter **21** connects the bus **12** to a display device **23** which may be embodied as an output device such as a monitor, printer, or transmitter, for example.

[0165] Computer program code for carrying out operations of the present invention may be written in a variety of computer programming languages. The program code may be executed entirely on at least one computing device (or processor), as a stand-alone software package, or it may be executed partly on one computing device and partly on a remote computer. In the latter scenario, the remote computer may be connected directly to the one computing device via a LAN or a WAN (for example, Intranet), or the connection may be made indirectly through an external computer (for example, through the Internet, a secure network, a sneaker net, or some combination of these).

[0166] It will be understood that each block of the flowchart illustrations and block diagrams and combinations of those blocks can be implemented by computer program instructions and/or means. These computer program instructions may be provided to a processor of a general purpose computer, special purpose computer, application specific integrated circuit (ASIC), or other programmable data processing apparatus to produce a machine, such that the instructions, which execute via the processor of the computer or other programmable data processing apparatus, create means for implementing the functions specified in the flowcharts or block diagrams.

VI. INDUSTRIAL APPLICABILITY

[0167] The invention has industrial applicability to predict a patient-specific diagnosis of disease. The invention utilizes a fully unsupervised, cross-validated, and dynamic BBN-ML that utilizes clinical parameters for determining the patient-specific diagnosis, which can be utilized to alter or improve the patient's lifestyle or to adjust therapy in a proactive manner.

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