CLAIMS

~~1.~~ 1. A computer system comprising:

a processing unit operatively coupled to memory to receive a plurality of conversation log files relating to interactions with an automated virtual dialog agent of a dialog system, each of the conversation log files comprising a trace of one or more dialog events; and

an artificial intelligence (AI) platform in communication with the processing unit, the AI platform comprising:

a trace manager configured to:

parse the dialog events of the traces of the conversation log files into a plurality of parsed events; and

extract respective behavioral characteristics from and assign respective behavioral characteristic values to the traces;

a cluster manager, operatively coupled to the trace manager, configured to cluster the traces into a plurality of clusters based on proximity of the respective behavioral characteristics values of the traces to respective outcome values, the plurality of clusters comprising a first cluster of the traces having the respective behavioral characteristic values proximate to a first outcome value representing a first outcome and a second cluster of traces having the respective behavioral characteristic values proximate to a second outcome value representing a second outcome that is different than the first outcome;

a search manager, operatively coupled to the cluster manager, configured to search the plurality of parsed events for a contrastive pattern, including applying a pattern specification entailing a temporal condition to at least one parsed event of the plurality of parsed events; and

for the at least one parsed event, the search manager configured to determine whether the contrastive pattern satisfies a contrastive threshold, wherein the contrastive pattern is based on a first proportion of the traces of the first cluster for which the pattern specification holds true and a second proportion of the traces of the second cluster for which the pattern specification holds not true; and

an output manager configured to apply output from the AI platform ~~to be applied~~ to the automated virtual dialog agent in relation to the dialog event corresponding to the at least one parsed event to improve performance of the dialog system.

~~2.~~ 2. The system of claim 1, wherein the search manager to determine whether the contrastive pattern satisfies the contrastive threshold comprises the search manager configured to multiply the first proportion by the second proportion to calculate a contrastive pattern value and compare the calculated contrastive pattern value to the contrastive threshold.

~~3.~~ 3. The system of claim 1, wherein the search manager to determine whether the contrastive pattern satisfies the contrastive threshold comprises the search manager configured to multiply the product of the first and second proportions by a weighting value in a range of 0 to 1 to calculate a contrastive pattern value and compare the calculated contrastive pattern value to the contrastive threshold.

~~4.~~ 4. The system of claim 1, wherein the behavior characteristics comprise a successful transaction by the dialog system and an unsuccessful transaction by the dialog system, respectively.

~~5.~~ 5. The system of claim 1, wherein the search manager applying a pattern specification entailing a temporal condition comprises the search manager configured to select the pattern specification from a plurality of pattern specifications, the plurality of pattern specifications stored in a first library.

~~6.~~ 6. The system of claim 5, wherein the search manager applying a pattern specification entailing a temporal condition to at least one parsed event of the plurality of parsed events comprises the search manager configured to select a variable specification corresponding to the at least one parsed event from a plurality of variable specifications stored in a second library, wherein the first and second libraries may be the same or different libraries.

7. A computer program product for improving performance of a virtual dialog agent system, the computer program product comprising~~-~~:

~~7.~~ a computer readable storage medium having program code embodied therewith, the program code executable by a processor to:

receive a plurality of conversation log files relating to interactions with an automated virtual dialog agent of a dialog system, the conversation log files comprising respective traces comprising one or more dialog events; and

apply the received conversation log files to an artificial intelligence (AI) platform comprising a learning program configured to:

parse the dialog events of the traces of the conversation log files into a plurality of parsed events;

extract respective behavioral characteristics from and assign respective behavioral characteristic values to the traces;

cluster the traces into a plurality of clusters based on proximity of the respective behavioral characteristics values of the traces to respective outcome values, the plurality of clusters comprising a first cluster of the traces having the respective behavioral characteristic values proximate to a first outcome value representing a first outcome and a second cluster of traces having the respective behavioral characteristic values proximate to a second outcome value representing a second outcome that is different than the first outcome;

search the plurality of parsed events for a contrastive pattern, the searching comprising applying a pattern specification entailing a temporal condition to at least one parsed event of the plurality of parsed events; and

for the at least one parsed event, determine whether the contrastive pattern satisfies a contrastive threshold, wherein the contrastive pattern is based on a first proportion of the traces of the first cluster for which the pattern specification holds true and a second proportion of the traces of the second cluster for which the pattern specification holds not true; and

apply output from the AI platform ~~to be applied~~ to the automated virtual dialog agent in relation to the dialog event corresponding to the at least one parsed event to improve performance of the dialog system.

~~8.~~ 8. The computer program product of claim 7, wherein the program code to determine whether the contrastive pattern satisfies the contrastive threshold comprises program code executable by the processor to multiply the first proportion by the second proportion to calculate a contrastive pattern value and compare the calculated contrastive pattern value to the contrastive threshold.

~~9.~~ 9. The computer program product of claim 7, wherein the program code to determine whether the contrastive pattern satisfies the contrastive threshold comprises program code executable by the processor to multiply the product of the first and second proportions by at least one weight value in a range of 0 to 1 to calculate a contrastive pattern value and compare the calculated contrastive pattern value to the contrastive threshold.

~~10.~~ 10. The computer program product of claim 7, wherein the behavior characteristics comprise a successful transaction by the dialog system and an unsuccessful transaction by the dialog system, respectively.

~~11.~~ 11. The computer program product of claim 7, wherein the program code to apply a pattern specification entailing a temporal condition comprises program code executable by the processor to select the pattern specification from a plurality of pattern specifications stored in a first library.

~~12.~~ 12. The computer program product of claim 11, wherein the program code to apply a pattern specification entailing a temporal condition to at least one parsed event of the plurality of parsed events comprises program code executable by the processor to select a variable specification corresponding to the at least one parsed event from a plurality of variable specifications stored in a second library, wherein the first and second libraries may be the same or different libraries.

~~13.~~ 13. A machine-implemented method of improving performance of a dialog system, the method comprising:

receiving, by a processor of a computing device, a plurality of conversation log files relating to interactions with an automated virtual dialog agent of a dialog system, the conversation log files comprising respective traces comprising one or more dialog events;

applying, by the processor, the received conversation log files to an artificial intelligence (AI) platform comprising a learning program, the applying comprising:

parsing the dialog events of the traces of the conversation log files into a plurality of parsed events;

extracting respective behavioral characteristics from and assigning respective behavioral characteristic values to the traces;

clustering the traces into a plurality of clusters based on proximity of the respective behavioral characteristics values of the traces to respective outcome values, the plurality of clusters comprising a first cluster of the traces having the respective behavioral characteristic values proximate to a first outcome value representing a first outcome and a second cluster of traces having the respective behavioral characteristic values proximate to a second outcome value representing a second outcome that is different than the first outcome;

searching the plurality of parsed events for a contrastive pattern, the search comprising applying a pattern specification entailing a temporal condition to at least one parsed event of the plurality of parsed events; and

for the at least one parsed event, search whether the contrastive pattern satisfies a contrastive threshold, wherein the contrastive pattern is based on a first proportion of the traces of the first cluster for which the pattern specification holds true and a second proportion of the traces of the second cluster for which the pattern specification holds not true; and

refining the automated virtual dialog agent in relation to the dialog event corresponding to the at least one parsed event to improve performance of the dialog system.

~~14.~~ 14. The machine-implemented method of claim 13, wherein the determining whether the contrastive pattern satisfies the contrastive threshold comprises multiplying the first proportion by the second proportion to calculate a contrastive pattern value and comparing the calculated contrastive pattern value to the contrastive threshold.

~~15.~~ 15. The machine-implemented method of claim 13, wherein the determining whether the contrastive pattern satisfies the contrastive threshold comprises multiplying the product of the first and second proportions by a weighting value in a range of 0 to 1 to calculate a contrastive pattern value and comparing the calculated contrastive pattern value to the contrastive threshold.

~~16.~~ 16. The machine-implemented method of claim 13, wherein the behavior characteristics comprise a successful transaction by the dialog system and an unsuccessful transaction by the dialog system, respectively.

~~17.~~ 17. The machine-implemented method of claim 13, wherein the applying a pattern specification entailing a temporal condition comprises selecting the pattern specification from a plurality of pattern specifications stored in a first library.

~~18.~~ 18. The machine-implemented method of claim 17, wherein the applying a pattern specification entailing a temporal condition to at least one parsed event of the plurality of parsed events comprises selecting a variable specification corresponding to the at least one parsed event from a plurality of variable specifications stored in a second library, wherein the first and second libraries may be the same or different libraries.

19. The machine-implemented method of claim 13, wherein the refining comprises refining, using the processor, the automated virtual dialog agent in relation to the dialog event corresponding to the at least one parsed event to improve performance of the dialog system.