

SYSTEMS AND METHODS FOR CONDUCTING AND ASSESSING REMOTE PSYCHOTHERAPY SESSIONS

FIELD OF THE INVENTION

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The invention relates to psychotherapy. In particular, the invention pertains to systems and methods for conducting and assessing remote psychotherapy sessions.

BACKGROUND OF THE INVENTION

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Psychotherapy and counselling sessions have traditionally been conducted in a therapist's office, where a patient may communicate and convey several information including the patient's experiences, feelings, history and other personal information to a therapist. Based on the information revealed by the patient, the therapist may provide appropriate therapy or counselling to the patient. As the internet technology has emerged as a global means of communication in the modern lifestyles, it has also been used as one of the modes for delivering the psychotherapy and counselling services to one or more patients.

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For example, PCT Publication No. WO 2016/071660 (A1) discloses a computer-based system for providing psychological therapy. The system includes a number of remote computing devices connected to a server via one or more network systems, where the server includes several system modules, preferably including an access system for controlling access to features and data by users of the remote devices (such as patients, therapists and supervisors) and a therapy system for enabling text-based instant messages to be sent between the patients and therapists. The access system is also configured to allow the patients to retrieve messages sent and received by the patient, the therapists to retrieve messages sent and received by the therapist, and the supervisors to retrieve messages sent and received by particular patients, therapists or both.

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U.S. Patent Publication No. US 2012/0320145 (A1) also discloses methods and systems

for online counselling sessions conducted over the internet. In some configurations, a method for remotely conducting counselling sessions between a client and an expert using an IP-based network includes providing a website accessible to the network wherein the expert and a client both have access to the website. In such configurations, upon accessing and logging into the website, the client is permitted to search a database for online experts and select an appropriate expert for a counselling session. In some configurations, the client initially completes various intake and/or registration forms in a virtual waiting room, wherein such forms are customized as per the relevant expert. The method continues as an expert remotely conducts a counselling session with the client via remote means, including video conferencing. Following the counselling session, the client is automatically returned to the virtual waiting room and provided with subsequent counselling-based options.

Although the internet enables the patients or general public to gain access to the psychotherapy and counselling services from home within minutes and cost effectively, there are inherent limitations in delivering these services via the internet. In particular, the internet psychotherapy and counselling sessions are more prone to miscommunications, as certain information including actual thoughts and feelings of the patients may be lost or inadequately conveyed during the online communications between the patients and the therapists. For example, text-based communications such as text messages and emails often lack the non-verbal cues associated with emotions. The patients or therapists may also lack the writing skills to adequately express themselves. Consequently, the messages delivered may be incorrectly interpreted by the therapists or patients, thereby affecting the effectiveness of the therapy or counselling sessions and possibly jeopardizing the relationship between the patients and the therapists.

In view of the foregoing, there exists a need to provide systems and methods to mitigate the limitations mentioned in the foregoing. There also exists a need to provide systems and methods for assessing and improving the relationship between the patients and therapists.

SUMMARY OF THE INVENTION

One of the objects of the invention is to provide improved systems and methods for remotely conducting psychotherapy between a therapist and one or more clients.

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Another object of the invention is to provide systems and methods enabling a plurality of data to be extracted and analysed in real-time or near real-time during each remote psychotherapy session, in order to generate indications which are insightful and helpful to the therapist in assessing the psychotherapy.

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Still another object of the invention is to introduce systems and methods enabling the therapist or therapists to review results generated after each psychotherapy session.

At least one of the preceding objects is met, in whole or in part, by the invention, in which one of the embodiments of the invention describes a system for conducting a remote psychotherapy between a therapist provided with a therapist computing device and at least a client provided with a client computing device, the system comprising a Natural Language Processing (NLP) module for converting the therapist's speeches and client's speeches captured and recorded during a two-way audio-video communication session established between the computing devices to text-based speech data, and then analyse the text-based speech data, to generate at least a first indication associated with a degree of verbal concordance between the therapist and client, and a second indication associated with an insight data in response to a therapist-client scenario; a paralinguistic feature analysing module for converting the therapist's paralinguistic features and the client's paralinguistic features captured and recorded during the communication session to paralinguistic data, and then analyse the paralinguistic data, to generate at least a third indication associated with the client's psychological state, and a fourth indication associated with the a degree of non-verbal concordance between the therapist and client; and a therapy assessment module in data communication with the NLP module and the paralinguistic feature analysing module.

In some embodiments, the paralinguistic features captured and recorded may comprise

body paralinguistic features and vocal paralinguistic features.

In some embodiments, the therapy assessment module may be configured to receive the first indication, second indication, third indication and fourth indication from the NLP module and paralinguistic feature analysing module after the psychotherapy has ended, and then assess the psychotherapy based on the indications by determining at least a first result in relation to therapeutic relationship between the therapist and the client, based on the first indication and fourth indication; a third result related to whether the client is honest or dishonest, based on the second indication and third indication; and a fourth result related to whether a therapeutic approach is effective, based on the second indication.

In some embodiments, the system may also comprise a baseline state analysing module configured to request for the client's reactions to a list of questions at the beginning of the psychotherapy and then determine a baseline indication associated with the client's baseline state based on the client's reactions. The client's reactions herein may include speeches, body paralinguistic features and vocal paralinguistic features, which may be analysed by the NLP module and paralinguistic feature analysing module.

In some embodiments, if more than one client is present in the psychotherapy, the NLP module may be further configured to generate a fifth indication associated with a degree of verbal concordance between any two clients, and the paralinguistic feature analysing module may also be further configured to generate a sixth indication associated with a degree of non-verbal concordance between any two clients.

In some embodiments, the therapy assessment module may further be configured to determine a second result in relation to the client's emotional valence score, based on the second indication, third indication and baseline indication; and determine a fifth result in relation to the therapeutic relationship between the two clients, based on the fifth indication and sixth indication.

The system may further comprise a feedback module in data communication with the

NLP module and the therapy assessment module. The feedback module may also be configured to allow the therapist to review and provide feedbacks in relation to the text-based speech data, indications and results received from the NLP module and therapy assessment module respectively.

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In some embodiments, the system may further comprise one or more databases to store data received from the NLP module, paralinguistic feature analysing module, baseline state analysing module and therapy assessment module.

- 10 A further embodiment of the invention is a method to conduct a remote psychotherapy between a therapist provided with a therapist computing device and at least a client provided with a client computing device, comprising the steps of establishing a two-way audio-video communication session between the therapist computing device and client computing device, wherein the computing devices are each operatively coupled
- 15 to the internet; capturing the therapist's reactions and the client's reactions during the communication session by using the computing devices, wherein the reactions to be captured may be speeches, body paralinguistic features, vocal paralinguistic features or a combination thereof; converting the captured speeches to text-based speech data using a NLP module, if the therapist's and the client's speeches are captured; analysing the
- 20 text-based speech data by using the NLP module, to generate at least a first indication associated with a degree of verbal concordance between the therapist and the client, and a second indication associated with an insight data in response to a therapist-client scenario; converting the captured paralinguistic features to a plurality of paralinguistic data by using a paralinguistic feature analysing module, if the therapist's paralinguistic
- 25 features and client's paralinguistic features are captured; analysing the paralinguistic data by using the paralinguistic feature analysing module, to generate at least a third indication associated with a psychological state of the client, and a fourth indication associated with a degree of non-verbal concordance between the therapist and the client; and assessing the psychotherapy based on the indications by using a therapy assessment
- 30 module to determine at least a first result in relation to therapeutic relationship between the therapist and the client, based on the first indication and fourth indication; a third result related to whether the client is honest or dishonest, based on the second indication

and third indication; and a fourth result related to whether a therapeutic approach is effective, based on the second indication.

5 The method may further comprise the steps of receiving the client's reactions to a list of questions by a baseline state analysing module at the beginning of the psychotherapy, and determining a baseline indication associated with the client's baseline state based on the client's reactions, by using the baseline state analysing module.

10 In some further embodiments, the method may further comprise the step of determining a second result in relation to the client's emotional valence score, based on the second indication, third indication and baseline indication. If more than one client is engaged in the psychotherapy, the method may further comprise the steps of determining a fifth indication associated with a degree of verbal concordance between a pair of selected clients, by using the NLP module; and determining a sixth indication associated with a
15 degree of non-verbal concordance between the selected clients, using the paralinguistic feature analysing module.

In some further embodiments, the method may further comprise the steps of receiving different types of inputs through a user interface of the therapist computing device, after
20 reviewing the text-based speech data, indications and results.

In some further embodiments, the method may further comprise the steps of storing a plurality of data received from the NLP module (104), paralinguistic feature analysing module (106), baseline state analysing module (108) and therapy assessment module
25 (110) respectively.

In some further embodiments, the method depicted in the foregoing may alternatively be stored and implemented as a series of instructions executable by either a computing device or a processing module of the computing device.

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One skilled in the art will readily appreciate that the invention is well adapted to carry out the aspects and obtain the ends and advantages mentioned, as well as those inherent

therein. The embodiments described herein are not intended as limitations on the scope of the invention.

BRIEF DESCRIPTION OF DRAWINGS

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For the purpose of facilitating an understanding of the invention, there is illustrated in the accompanying drawing the preferred embodiments from an inspection of which when considered in connection with the following description, the invention, its construction and operation and many of its advantages would be readily understood and
10 appreciated.

Figure 1 shows a system for conducting and assessing a remote psychotherapy session between a therapist and a client, according to one embodiment.

15 Figure 2 shows a system for conducting and assessing a remote psychotherapy session between a therapist and more than a client, according to another embodiment.

Figure 3 shows a general flow chart of a method for conducting and assessing a remote psychotherapy session between a therapist and a client, according to one embodiment.

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Figure 4 shows a general flow chart detailing steps to be performed for reviewing data generated in relation to a remote psychotherapy session between a therapist and a client, according to one embodiment.

25 Figure 5 shows a general flow chart of a method for conducting and assessing a remote psychotherapy session between a therapist and more than a client, according to another embodiment.

Figure 6 shows a general flow chart detailing steps to be performed for reviewing data
30 generated in relation to a remote psychotherapy session between a therapist and more than a client, according to another embodiment.

DETAILED DESCRIPTION OF THE INVENTION

Hereinafter, the invention shall be described according to the preferred embodiments of the invention and by referring to the accompanying description and drawings. It is, however, to be understood that limiting the description to the preferred embodiments of the invention and to the drawings is merely to facilitate discussion of the invention and that it is envisioned that those skilled in the art may devise various modifications without departing from the scope of the appended claim.

10 The terms “client” and “patient” are used interchangeably throughout the specification to refer to a recipient of a remote psychotherapy session.

The invention provides systems and methods for remotely conducting psychotherapy between a therapist and one or more clients. The systems and methods may also require that a plurality of data be extracted and analysed in real-time or near real-time during each remote psychotherapy session, in order to generate indications which are insightful and helpful to the therapist in assessing the psychotherapy session.

Embodiment 1

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Figure 1 shows a system for conducting a psychotherapy session remotely and over the internet between a therapist and a client, according to one embodiment of the invention. As shown, the therapist is provided with a therapist computing device (102a) and the client is provided with a client computing device (102b). The computing devices (102a, 102b) may each be a computing device operable to establish an internet connection and access a web application or web browsing application, such as a desktop computer, a laptop computer, a tablet computer or a mobile smart phone, but each computing device (102a, 102b) may preferably be provided with at least a video camera to record an image of a person, a microphone to record sound of a person and a speaker to play audio to a person. Thereby, a two-way audio-video communication session could be established between the therapist and the patient during the psychotherapy.

Each computing device (102a, 102b) may further be configured to capture and record the therapist's reactions and the client's reactions during the psychotherapy session by using the video camera and microphone. The reactions to be captured and recorded may comprise one or more of the following: the therapist's speeches, the client's speeches, 5 the therapist's body paralinguistic features (such as the therapist's facial expressions, eye movements, gestures and postures), the client's body paralinguistic features (such as the client's facial expressions, eye movements, gestures and postures), the therapist's vocal paralinguistic features (such as the therapist's pitch, loudness or sound pressure, timbre and tone) and the client's vocal paralinguistic features (such as the client's pitch, 10 loudness or sound pressure, timbre and tone).

Depending on the reactions to be captured and recorded, the reactions may be recorded in the form of either an audio file or a video file. For example, the speeches and vocal paralinguistic features of Client A₁ may be recorded in the form of an audio file, while 15 the body paralinguistic features of Client A₁ may be recorded in the form of a video file. In the events where the speeches recorded are of poor quality or not clear, further processing may be required, which will be described in the following.

After successfully capturing and recording the reactions, the audio and video files may 20 be processed to provide the therapist with insightful and helpful indications in assessing the psychotherapy session including the therapeutic relationship or alliance between the therapist and client. To achieve such object, the system may be provided with several processing modules, such as a natural language processing (NLP) module (104) and a paralinguistic analysing module (106). The system may also be configured to enable 25 data transmission or communication between the computing devices (102a, 102b), NLP module (104) and paralinguistic analysing module (106).

In some embodiments, the NLP module (104) may be configured to receive the audio files from the therapist computing device (102a) and client computing device (102b) in 30 real-time or near real-time during a psychotherapy session. The NLP module (104) may also be configured to convert the speeches in the audio files to text-based speech data and analyse the speech data to generate at least a first indication and a second indication.

The first indication may be associated with a degree of verbal concordance between the therapist and the client, whereas the second indication may be associated with an insight data in response to a particular therapist-client scenario.

- 5 As for the paralinguistic feature analysing module (106), it may be configured to receive the audio files comprising the vocal paralinguistic features and video files comprising the body paralinguistic features from the therapist computing device (102a) and client computing device (102b) during the psychotherapy session, in real-time or near real-time. The paralinguistic feature analysing module (106) may be configured to convert
- 10 the paralinguistic features to a plurality of paralinguistic data and subsequently analyse the paralinguistic data, in order to generate at least a third indication associated with a psychological state of the client and a fourth indication associated with a degree of non-verbal concordance between the therapist and the client. In one embodiment, the psychological state may be a mental state (such as fatigue, sleepiness, concentration,
- 15 etc.), emotional state (such as anger, fear, sadness, frustration, etc.) or a combination of both. In another embodiment, the psychological state may be the client's concentration level. In still another embodiment, instead of a single module, the paralinguistic feature analysing module (106) may be made up of a body paralinguistic feature analysing sub-module (to analyse only body paralinguistic features) and a vocal paralinguistic feature
- 20 analysing sub-module (to analyse only vocal paralinguistic features), the sub-modules being capable of establishing a data communication with each other.

- In addition to the NLP module (104) and paralinguistic feature analysing module (106), the system may also comprise a baseline state analysing module (108) configured to be
- 25 in data communication with the client computing device (102b), NLP module (104) and paralinguistic feature analysing module (106). The baseline state analysing module (108) may be configured to determine a baseline indication associated with the client's baseline state (or "initial state") at the beginning of the psychotherapy session. In order to determine the baseline indication, the baseline state analysing module (108) may
- 30 prompt and invite the client to react to a list of questions displayed to the client through the client computing device (102b) or posed to the client by the therapist at the beginning of the psychotherapy session. The client's reactions in response to the list of

questions may be captured and recorded by the client computing device (102b). The reactions to be captured and recorded may comprise the client's speeches, the client's body paralinguistic features (such as the client's facial expressions, eye movements, gestures and postures) and the client's vocal paralinguistic features (such as the client's pitch, loudness or sound pressure, timbre and tone). The client's reactions may also be analysed using the NLP module (104) and paralinguistic feature analysing module (106). Subsequently, based on the analyses performed by the NLP module (104) and paralinguistic feature analysing module (106), the baseline state analysing module (108) may be configured to determine a baseline indication associated with the client's baseline state. The baseline indication may further be processed to assess fluctuations in the emotional valence of the client during the psychotherapy session. If more than one psychotherapy session may be conducted, the baseline indication for each of the psychotherapy session may be recorded and accumulated, thus allowing for monitoring of the client's overall progress and the effectiveness of the therapeutic treatment plan. Accumulation of the baseline indications may also enable changes in the psychological or emotional states of the same client to be tracked in the present psychotherapy session and across multiple psychotherapy sessions.

The system may also comprise a therapy assessment module (110) configured to be in data communication with the NLP module (104), the paralinguistic feature analysing module (106) and the baseline state analysing module (108) to receive the first, second, third, fourth and baseline indications. The therapy assessment module may also be configured to assess the psychotherapy session upon processing these indications. For instance, the therapy assessment module (110) may be configured to determine one or more of the following: a first result in relation to the therapeutic relationship or alliance between the therapist and the client, based on the first and fourth indications; a second result in relation to the client's emotional valence score, based on the second indication, third indication and the client's baseline indication; a third result related to whether the client is honest or dishonest, based on the second indication and third indication; and a fourth result related to whether the therapeutic approach is effective, based on the second indication.

In certain embodiments, the system may also comprise a database (120). The database (120) may be configured to be in data communication with the NLP module (104), the paralinguistic feature analysing module (106), the baseline state analysing module (108) and the therapy assessment module (110) respectively. The database (120) may also be configured to store a plurality of data, for instance but not limited to the audio files, video files, text-based speech data, body paralinguistic data, vocal paralinguistic data, indications and results generated. In some embodiments, the data may be sorted and stored in the database (120) according to the name of the client. For instance, all data pertaining to a psychotherapy session between Therapist A₁ and Client A₁ may be stored under a record belonging to Client A₁. Accordingly, the record of Client A₁ may comprise one or more of the following: Therapist A₁'s audio files, Therapist A₁'s video files, Therapist A₁'s speech data, Therapist A₁'s body paralinguistic data, Therapist A₁'s vocal paralinguistic data, Client A₁'s audio files, Client A₁'s video files, Client A₁'s speech data, Client A₁'s body paralinguistic data, Client A₁'s vocal paralinguistic data, indications and results generated. In some other embodiments, more than a database (120) may be provided depending on the system configuration.

The system may further comprise a feedback module (130) in data communication with the NLP module (104) and therapy assessment module (110). Presence of the feedback module (130) may enable a feedback loop to be established, hence allowing continuous training, retraining or fine-tuning to the steps, operations or algorithms to be executed. Thereby, accuracy of the analyses and results could be improved.

In some embodiments, the feedback module (130) may be configured to mitigate issues caused by the recorded speeches which are of poor quality or unclear. In particular, in the events where the recorded speeches are of poor quality or unclear, the NLP module (104) may encounter difficulties in identifying the correct words based on the recorded speeches. As a result, the text-based speech data produced by the NLP module (104) may be erroneous and inaccurate, which affects the assessment of the psychotherapy session or in particular the performance of the therapy assessment module (110).

In order to avoid the aforementioned circumstances, the feedback module (130) may be

configured to transfer and display the text-based speech data to the therapist for viewing via a user interface on a display device of the therapist computing device (102a) after the psychotherapy session has ended. The user interface may also allow the therapist to provide a confirmation input that the text-based speech data do not require corrections.

- 5 Upon the confirmation input, the feedback module (130) may be configured to transmit a signal to the NLP module (104), notifying that the NLP module (104) may upload the originally generated speech data to the database (120).

- Alternatively, if the text-based speech data contain errors that need to be corrected, the
- 10 feedback module (130) may enable the therapist to provide a correction input through the user interface mentioned in the foregoing, to correct the errors in the speech data. Subsequently, the feedback module (130) may transfer the corrected speech data to the NLP module (104), so that the first and second indications may be updated by the NLP module (104) according to the corrected speech data, before transferring the updated
- 15 indications to the therapy assessment module (110) to update the results and/or before uploading the latest information (e.g. the corrected speech data, updated indications and updated results) to the database (120).

- The feedback module (130) may be further configured to transmit various information
- 20 from the therapy assessment module (108) to the therapist computing device (102a) for the therapist to review after the psychotherapy session has ended. The information to be transmitted and reviewed may comprise the first indication, second indication, third indication, fourth indication, first result, second result, third result and fourth result. In certain embodiments, the text-based speech data and information may be transmitted
- 25 from the NLP module (104) and the therapist assessment module (108) to the therapist computing device (102a) simultaneously.

- Similarly, the feedback module (130) may enable the therapist to review the indications and results received from the therapy assessment module (110), upon displaying via the
- 30 user interface on the display device of the therapist computing device (102a). When the therapist does not detect any suspicious trends or have comments on the indications and results, the feedback module (130) may enable the therapist to provide a confirmation

input through the user interface on the therapist computing device (102a). Upon receipt of the confirmation input, the feedback module (130) may be configured to generate a signal to the therapy assessment module (110), notifying that the therapy assessment module (110) may upload all of the information to the database (120).

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In contrast, if the therapist detects suspicious trends on the indications and results, the feedback module (130) may enable the therapist to provide a comment input comprising comments on the detected suspicious trends through the user interface on the therapist computing device (102a). Subsequently, the feedback module (130) may be configured to convert the comment input to a plurality of comment data, so that the comment data can be tagged to the corresponding indications or results, before uploading all of the information to the database (120). In certain embodiments, the feedback module (130) may also be configured to transfer the comment data to the therapy assessment module (110), so that the tagging may be performed by the therapy assessment module (110).

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Although the foregoing system may be described in such a way that the NLP module (104), paralinguistic feature analysing module (106), baseline state analysing module (108), therapy assessment module (110), database (120) and feedback module (130) may each be a separate or individual module, it should be appreciated that in certain embodiments, these modules may be integral parts of the therapist computing device (102a), depending on the system configuration.

It should also be appreciated that in certain embodiments, the first indication, second indication, third indication, fourth indication, baseline indication, first result, second result, third result and fourth result may be expressed in term of scores. Accordingly, these scores may be provided and compared with ranges comprising a low range, a normal range and a high range. In some embodiments, these ranges may also be updated periodically.

30 Embodiment 2

Figure 2 shows a system for conducting a psychotherapy session remotely and over the

internet between a therapist and more than one client, according to another embodiment of the invention. There may exist one therapist computing device (102a) and more than one client computing device (102b), each of which may preferably be provided with at least a video camera, a microphone and a speaker, in order to establish a two-way audio-
5 video communication during the psychotherapy session.

Each computing device (102a, 102b) may also be configured to capture and record the reactions of the therapist and each of the clients during the psychotherapy session using the video camera and microphone provided. The reactions to be captured and recorded
10 may comprise one or more of the following: the therapist's speeches, the client's speeches, the therapist's body paralinguistic features (such as the therapist's facial expressions, eye movements, gestures and postures), the client's body paralinguistic features (such as the client's facial expressions, eye movements, gestures and postures), the therapist's vocal paralinguistic features (such as the therapist's pitch, loudness or
15 sound pressure, timbre and tone) and the client's vocal paralinguistic features (such as the client's pitch, loudness or sound pressure, timbre and tone).

Depending on the reactions to be captured and recorded, the reactions may be recorded in the form of either an audio file or a video file. For example, the speeches and vocal
20 paralinguistic features of Client A₂ may be recorded in the form of an audio file, while the body paralinguistic features of Client A₂ may be recorded in the form of a video file.

After successfully capturing and recording the reactions, the audio and video files may
25 be processed to provide the therapist with insightful and helpful indications in assessing the psychotherapy session including the therapeutic relationship or alliance between the therapist and each of the clients. To achieve such object, the system may be provided with several processing modules, such as a natural language processing (NLP) module (104) and a paralinguistic analysing module (106). The system may also be configured
30 to enable data transmission or communication between the computing devices (102a, 102b), NLP module (104) and paralinguistic analysing module (106).

The NLP module (104) may be configured to receive the audio files from the therapist computing device (102a) and each of the client computing devices (102b) in real-time or near real-time during a psychotherapy session. The NLP module (104) may also be configured to convert the speeches in the audio files to text-based speech data and then

5 analyse the speech data to generate at least a first indication and a second indication for each of the clients participated in the psychotherapy session. The first indication may be associated with a degree of verbal concordance between the therapist and a particular client, whereas the second indication may be associated with an insight data in response to a particular therapist-client scenario. The NLP module (104) may also be configured

10 to analyse the text-based speech data for generating a fifth indication, in which the fifth indication may be associated with a degree of verbal concordance between two clients, such as between Client A₂ and Client B₂, between Client A₂ and Client C₂, between Client B₂ and Client C₂, etc.

15 As for the paralinguistic feature analysing module (106), it may be configured to receive the audio files comprising the vocal paralinguistic features and video files comprising the body paralinguistic features from the therapist computing device (102a) and client computing devices (102b). Similarly, the transfer of the audio and video files from the computing devices (102a, 102b) to the paralinguistic feature analysing module (106)

20 may take place in real-time or near real-time during the psychotherapy session. Upon receipt of the audio and video files, the paralinguistic feature analysing module (106) may be configured to convert the paralinguistic features to a plurality of paralinguistic data and then analyse the paralinguistic data to generate at least a third indication for each of the clients participated in the psychotherapy session. The third indication may

25 be associated with a psychological state of a particular client, wherein the psychological state may be a mental state (such as fatigue, sleepiness, concentration, etc.), emotional state (such as anger, fear, sadness, frustration, etc.), socio-emotional state (such as guilt, embarrassment, jealousy, etc.) or any combination thereof. In certain embodiments, the psychological state may preferably be the concentration level of a particular client.

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The paralinguistic feature analysing module (106) may also analyse the paralinguistic data to generate a fourth indication and a sixth indication for each of the clients in the

psychotherapy session. The fourth indication may be associated with a degree of non-verbal concordance between the therapist and a particular client, and the sixth indication may be associated with a degree of non-verbal concordance between two of the clients in the psychotherapy session, such as between Client A₂ and Client B₂, between Client
5 A₂ and Client C₂, between Client B₂ and Client C₂, etc.

It should also be appreciated that instead of a single module, the paralinguistic feature analysing module (106) may be made up of a body paralinguistic feature analysing sub-module (to analyse only body paralinguistic features) and a vocal paralinguistic feature
10 analysing sub-module (to analyse only vocal paralinguistic features), the sub-modules being capable of establishing a data communication with each other.

In addition to the NLP module (104) and paralinguistic feature analysing module (106), the system may also comprise a baseline state analysing module (108) configured to be
15 in data communication with the NLP module (104), paralinguistic feature analysing module (106) and client computing devices (102b). The baseline state analysing module (108) may additionally be configured to determine a baseline indication associated with the baseline state or initial state for each client, at the beginning of the psychotherapy session. To determine the baseline indication, the baseline state analysing module (108)
20 may be configured to prompt and invite each of the clients to react to a list of questions displayed to the client through the client computing devices (102b) or posed to the client by the therapist at the beginning of the psychotherapy session. Their reactions in response to the questions may be captured and recorded by the respective client computing devices (102b), wherein the reactions to be captured and recorded may
25 comprise the client's speeches, the client's body paralinguistic features (such as the client's facial expressions, eye movements, gestures and postures) and the client's vocal paralinguistic features (such as the client's pitch, loudness or sound pressure, timbre and tone). The reactions of the clients may each be analysed by the NLP module (104) and paralinguistic feature analysing module (106). Based on the analyses performed by
30 the NLP module (104) and paralinguistic feature analysing module (106), the baseline state analysing module (108) could determine a baseline indication associated with the baseline state for each of the clients. The baseline indications may further be processed

to assess fluctuations in the emotional valence of a particular client (or the emotional valence of each client) during the psychotherapy session. If more than a psychotherapy session may be conducted, the baseline indication for each psychotherapy session may be recorded and accumulated, hence allowing for monitoring of the overall progress of the same client (or each client engaged in the psychotherapy session) and effectiveness of the therapeutic treatment plan. Accumulation of the baseline indications may also enable changes in the client's psychological or emotional states to be tracked within the present psychotherapy session and across multiple psychotherapy sessions.

10 Accordingly, in a psychotherapy session between a therapist and more than one client, multiple first indications, second indications, third indications, fourth indications, fifth indications, sixth indications and baseline indications may be generated and obtained, as each client may have his first indication, second indication, third indication, fourth indication, fifth indication, sixth indication and baseline indication.

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The system may also comprise a therapy assessment module (110) configured to be in data communication with the NLP module (104), the paralinguistic feature analysing module (106) and the baseline state analysing module (108), in order to receive the first indications, second indications, third indications, fourth indications, fifth indications, sixth indications and baseline indications therefrom. The therapy assessment module (110) may also be configured to assess the psychotherapy session upon processing these indications. For instance, for each of the clients engaged in the psychotherapy session, the therapy assessment module (110) may be configured to determine one or more of the following: a first result in relation to the therapeutic relationship or alliance between the therapist and the client, based on the first and fourth indications; a second result in relation to the client's emotional valence score, based on the second, third and baseline indications; a third result related to whether the client is honest or dishonest, based on the second and third indications; a fourth result related to whether the therapeutic approach is effective, based on the second indication; and a fifth result in relation to the therapeutic relationship between the client and another client, based on the fifth and sixth indications.

In certain embodiments, the system may also comprise a database (120). The database (120) may be configured to be in data communication with the NLP module (104), the paralinguistic feature analysing module (106), the baseline state analysing module (108) and the therapy assessment module (110) respectively. The database (120) may also be configured to store a plurality of data, for instance but not limited to the audio files, video files, text-based speech data, body paralinguistic data, vocal paralinguistic data, indications and results generated. In some embodiments, the data may be sorted and stored in the database (120) according to the client's name. For instance, all data pertaining to a psychotherapy session between Therapist A₂, Client A₂ and Client B₂ may be duplicated, so that the data may be stored under a record belonging to Client A₂ and a record belonging to Client B₂ respectively. Accordingly, the record of Client A₂ or Client B₂ may comprise one or more of the following: Therapist A₂'s audio files, Therapist A₂'s video files, Client A₂'s audio files, Client A₂'s video files, Client B₂'s audio files, Client B₂'s video files, Therapist A₂'s speech data, Client A₂'s speech data, Client B₂'s speech data, Therapist A₂'s body paralinguistic data, Client A₂'s body paralinguistic data, Client B₂'s body paralinguistic data, Therapist A₂'s vocal paralinguistic data, Client A₂'s vocal paralinguistic data, Client B₂'s vocal paralinguistic data, indications and results generated. In some embodiments, more than one database (120) may be provided depending on the system configuration.

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The system may further comprise a feedback module (130) in data communication with the NLP module (104) and the therapy assessment module (110). As mentioned in the foregoing, presence of the feedback module (130) may enable a feedback loop to be established, hence allowing continuous training, retraining or fine-tuning to the steps, operations or algorithms to be executed. Consequently, the accuracy of the analyses and results could be improved.

In some embodiments, the feedback module (130) may be configured to mitigate issues caused by the recorded speeches which are of poor quality or unclear. In particular, in the events where the recorded speeches are of poor quality or not clear, the NLP module (104) may encounter difficulties in identifying the correct words based on the recorded speeches. As a result, the text-based speech data produced by the NLP module (104)

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may be erroneous and inaccurate, thereby affecting the assessment of the psychotherapy session or in particular the performance of the therapy assessment module (110).

In order to avoid the aforementioned circumstances, the feedback module (130) may be
5 configured to transfer and display the text-based speech data to the therapist for viewing
via a user interface on a display device of the therapist computing device (102a) after
the psychotherapy session has ended. The user interface may also allow the therapist to
provide a confirmation input that the text-based speech data do not require corrections.
Upon the confirmation input, the feedback module (130) may be configured to transmit
10 a signal to the NLP module (104), notifying that the NLP module (104) may upload the
originally generated speech data to the database (120).

Alternatively, if the text-based speech data contain errors that need to be corrected, the
feedback module (130) may enable the therapist to provide a correction input through
15 the user interface mentioned in the foregoing, to correct the errors in the speech data.
Subsequently, the feedback module (130) may transfer the corrected speech data to the
NLP module (104), so that the NLP module (104) may generate the updated indications
based on the corrected speech data, before transferring the updated indications to the
therapy assessment module (110) to update the results and/or before uploading the latest
20 information (e.g. the corrected speech data, updated indications and updated results) to
the database (120).

The feedback module (130) may be further configured to transmit various information
from the therapy assessment module (108) to the therapist computing device (102a) for
25 the therapist to review, after the psychotherapy session has ended. The information to
be transmitted and reviewed may comprise the first indications, second indications,
third indications, fourth indications, fifth indications, sixth indications, first results,
second results, third results, fourth results and fifth results. In certain embodiments, the
text-based speech data and information may be transmitted simultaneously from the
30 NLP module (104) and the therapy assessment module (110) to the therapist computing
device (102a).

Similarly, the feedback module (130) may enable the therapist to review the indications and results received from the therapy assessment module (110), upon displaying via the user interface on the display device of the therapist computing device (102a). When the therapist does not detect any suspicious trends or have comments on the indications and results, the feedback module (130) may enable the therapist to provide a confirmation input through the user interface on the therapist computing device (102a). Upon receipt of the confirmation input, the feedback module (130) may be configured to generate a signal to the therapy assessment module (110), notifying that the therapy assessment module (110) may upload all of the information to the database (120).

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In contrast, if the therapist detects suspicious trends on the indications and results, the feedback module (130) may enable the therapist to provide a comment input comprising comments on the detected suspicious trends through the user interface on the therapist computing device (102a). Subsequently, the feedback module (130) may be configured to convert the comment input to a plurality of comment data, so that the comment data can be tagged to the corresponding indications or results, before uploading all of the information to the database (120). In alternative embodiments, the feedback module (130) may be configured to transfer the comment data to the therapy assessment module (110), so that the tagging may be performed by the therapy assessment module (110).

20

Although the system may be described in this embodiment in such a way that the NLP module (104), paralinguistic feature analysing module (106), baseline state analysing module (108), therapy assessment module (110), database (120) and feedback module (130) may each be a separate or individual module, it should be appreciated that in some embodiments, these modules may be integral parts of the therapist computing device (102a), depending on the system configuration.

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It should also be appreciated that in certain embodiments, the first indications, second indications, third indications, fourth indications, fifth indications, sixth indications, baseline indications, first results, second result, third result, fourth results and fifth results may be expressed in terms of scores. Accordingly, these scores may be provided and compared with ranges comprising a low range, a normal range and a high range. In

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some embodiments, these ranges may be updated periodically.

Embodiment 3

- 5 In further embodiments, a method for conducting a remote psychotherapy between a therapist and a client may be provided. The method may also be performed by using the system described in the foregoing.

Before initiating a psychotherapy, the client or the patient may be required to schedule
10 an appointment with the therapist, as at Step S201 in Figure 3. Later, at the appointed date and time, the therapist and the client may be required to establish a communication session, as at Step S203, via a web application or web browsing application accessible on the therapist computing device (102a) and the client computing client (102b). To establish such communication session, the computing devices (102a, 102b) may be
15 required to connect to the internet first.

The psychotherapy conducted between the therapist and client may also be preferably a two-way audio-video communication session. To achieve such object, the therapist computing device (102a) and the client computing device (102b) may respectively be
20 provided with at least a video camera to record an image of a person, a microphone to record sound of a person and a speaker to play audio to a person.

In some further embodiments, it may be required to determine a baseline indication associated with the client's baseline state (or "initial state") at the beginning of the
25 psychotherapy session. In order to determine the baseline indication, the client may be invited and required by the baseline analysing module (108), at Step S205, to react to a plurality of questions displayed to the client on the client computing device (102b) or posed to the client by the therapist at the beginning of the psychotherapy session. The client's reactions in response to the questions may be captured and recorded using the
30 video camera and microphone provided to the client computing device (102b), wherein the reactions to be captured and recorded may comprise the client's speeches, the client's body paralinguistic features (such as the client's facial expressions, eye

movements, gestures and postures) and the client's vocal paralinguistic feature (such as the client's pitch, loudness or sound pressure, timbre and tone). The client's reactions may also be analysed using the NLP module (104) and paralinguistic feature analysing module (106). Subsequently, based on the analyses performed by the NLP module (104) and paralinguistic feature analysing module (106), a baseline score associated with the client's baseline state may be computed by the baseline analysing module (108), at Step S207.

Once the client's baseline indication is determined, the psychotherapy may be initiated, as at Step S209. During the psychotherapy or the communication session, the therapist's reactions and client's reactions may be captured and recorded, as at Step S211 and Step S221, using the video camera and microphone provided to the computing devices (102a, 102b). The reactions to be captured and recorded may be one or more of the following: the therapist's speeches, the client's speeches, the therapist's body paralinguistic features (such as the therapist's facial expressions, eye movements, gestures and postures), the client's body paralinguistic features (such as the client's facial expressions, eye movements, gestures and postures), the therapist's vocal paralinguistic features (such as the therapist's pitch, loudness or sound pressure, timbre and tone) and the client's vocal paralinguistic features (such as the client's pitch, loudness or sound pressure, timbre and tone). Depending on the reactions to be captured and recorded, the reactions may be recorded in the form of an audio file or a video file.

If the reactions captured and recorded are the therapist's and the client's speeches, the reactions may be recorded in the form of an audio file. These audio files may then be transferred to the NLP module (104) which converts the speeches in the audio files to text-based speech data, as at Step S213. Subsequently, at Step S215, the NLP module (104) may analyse the speech data to generate at least a first indication and a second indication, wherein the first indication may be associated with a degree of verbal concordance between the therapist and the client, and the second indication may be associated with an insight data in response to a particular therapist-client scenario.

To obtain the first indication, the following operations may be performed. The NLP

module (104) may compare the therapist's speech data and the client's speech data by using a Language Style Matching (LSM) algorithm to identify one or more function words from different categories. The function word categories may include but not limited to auxiliary verbs, articles, common adverbs, particle pronouns, indefinite
 5 impersonal pronouns, prepositions and relative pronouns, negations, conjunctions and quantifiers. Upon identifying the function words in the respective categories, a score may be calculated by the NLP module (104) for each of the function word categories by using Equation (1), wherein FW is the number of function words. Accordingly, by taking an average value of the scores calculated for each function word category, a
 10 composite LSM score may be obtained and referred to as the "first indication". It also indicates great matching between the therapist and client if the composite LSM score is high.

$$1 - \frac{|FW_{client} - FW_{therapist}|}{FW_{client} + FW_{therapist} + 0.0001} \quad (1)$$

15

To obtain the second indication, the following operations may be performed. The NLP module (104) may analyse the therapist's speech data and the client's speech data to identify certain keywords and compare the identified keywords with a list of insight conditions, before generating a second indication associated with an insight data in
 20 response to a particular therapist-client scenario. In one exemplary embodiment, the NLP module (104) may analyse the client's speech data and identify or detect that the client is using a high rate of emotion words during the psychotherapy session. Hence, the NLP module (104) may generate a second indication alerting the therapist of such situation. The second indication may also comprise a suggestion to the therapist, such
 25 as minimising the use of cognitively geared verbs in the communication between the therapist and the client. In another exemplary embodiment, the NLP module (104) may analyse the therapist's speech data and identify or detect that the therapist's speeches do not contain words or phrases characterising a therapeutic approach adopted by the therapist. Accordingly, the NLP module (104) may generate a second indication alerting
 30 the therapist of such situation.

If the reactions captured and recorded are the paralinguistic features of the therapist and the paralinguistic features of the client, the reactions may be recorded in the form of a video file. These video files may be transferred to the paralinguistic feature analysing module (106) which may convert the paralinguistic features contained in the video files to a plurality of paralinguistic data, as at Step S223, and analyse the paralinguistic data to generate at least a third indication, as at Step S225. For instance, the paralinguistic feature analysing module (106) may process the client's body paralinguistic features by using a facial action recognition algorithm which identifies and analyses movements of different facial muscles. Additionally, the paralinguistic feature analysing module (106) may process the vocal paralinguistic features of the client by identifying and analysing different vocal characteristics. Based upon the analyses on the client's body and vocal paralinguistic features, the paralinguistic feature analysing module (106) may generate the third indication associated with a psychological state of the client. In one exemplary embodiment, the psychological state may be a mental state (such as fatigue, sleepiness, concentration, etc.), emotional state (such as anger, fear, sadness, frustration, etc.) or a combination of both. In another exemplary embodiments, the psychological state may preferably be the client's concentration level.

In certain other further embodiments, the paralinguistic feature analysing module (106) may also analyse the paralinguistic data to generate a fourth indication associated with a degree of non-verbal concordance between the therapist and the client.

Although the first indication, second indication, third indication, fourth indication and baseline indication may each relate to a specific aspect of the psychotherapy session, these indications may be subjected to further processing using the therapy assessment module (110), in order to enable more meaningful and insightful assessment in relation to the psychotherapy session. For instance, upon processing the indications, the therapy assessment module (110) may determine one or more of the following: a first result in relation to the therapeutic relationship or alliance between the therapist and client, based on the first and fourth indications; a second result in relation to the client's emotional valence score, based the second, third and baseline indications; a third result related to whether the client is honest or dishonest, based on the second and third indications; and

a fourth result related to whether the therapeutic approach is effective, based on the second indication.

In some further embodiments, various information may be transmitted from the therapy assessment module (110) to the therapist computing device (102a) through the feedback module (130) after the psychotherapy session has ended, as at Step S241 in Figure 4, thereby enabling the therapist to review the information before uploading and storing them onto a database (120), as at Step S245 in Figure 4. The information to be reviewed may comprise the first indication, second indication, third indication, fourth indication, first result, second result and third result.

In some further embodiments, the feedback module (130) may transfer and display the indications and results to the therapist for viewing through a user interface on a display device of the therapist computing device (102a). Accordingly, it enables the therapist to review and provide feedbacks about the indications and results. During review, if the therapist does not detect any suspicious trends or have comments on the indications and results, the therapist may provide a confirmation input to the feedback module (130) via the user interface on the therapist computing device (102a). Upon the confirmation input, the feedback module (130) may generate a signal to the therapy assessment module (110), as at Step S251, notifying that the therapy assessment module (110) may upload all of the information to the database (120), as at Step S253.

In contrast, if the therapist detects suspicious trends on the indications and results during review, the therapist may provide a comment input comprising comments on the detected suspicious trends to the feedback module (130) through the user interface on the therapist computing device (102a). Subsequently, the feedback module (130) may convert the comment input to a plurality of comment data, so that they can be tagged to the corresponding indications or results, before uploading all of the information to the database (120).

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Besides the indications and results, the text-based speech data may also be transmitted from the NLP module (104) to the therapist computing device (102a) for review, via the

feedback module (130), as at Step S243 and Step S245 in Figure 4.

In particular, the feedback module (130) may transfer and display the text-based speech data to the therapist for viewing through the user interface on the therapist computing device (102a). In the events where the therapist detects that the text-based speech data contain errors, the therapist may provide a correction input through the user interface, in order to correct the errors in the speech data. The feedback module (130) may then transfer the corrected speech data back to the NLP module (104), as at Step S251, thereby enabling the NLP module (104) to update the first and second indications based on the corrected speech data, before transferring the updated indications to the therapy assessment module (108) to update the results and/or uploading the latest information (e.g. the corrected speech data, updated indications and updated results) to the database (120), as at Step S253.

In contrast, if the therapist confirms that the text-based speech data do not require any corrections, the therapist may provide a confirmation input through the user interface on the therapist computing device (102a) to the feedback module (130). Upon receipt of the confirmation input, the feedback module (130) may generate and transmit a signal to the NLP module (104), as at Step S251, notifying that the NLP module (104) may upload the originally generated speech data to the database (120), as at Step S253.

It should be appreciated that the first indication, second indication, third indication, fourth indication, baseline indication, first result, second result, third result and fourth result may be expressed in term of scores. Accordingly, these scores may be provided and compared with ranges comprising a low range, a normal range and a high range. In some further embodiments, these ranges may be updated periodically.

Embodiment 4

In other further embodiments, a method for conducting a remote psychotherapy session between a therapist and more than a client may be provided. The method may also be performed using the system described in the foregoing.

Before initiating a psychotherapy, two or more clients may be required to schedule an appointment with the therapist, as at Step S301 in Figure 5. At the appointed date and time, the therapist and the clients may be required to establish a communication session, as at Step S303, via a web application or a web browsing application accessible on the therapist computing device (102a) and the client computing devices (102b). To establish such communication session, the computing devices (102a, 102b) may be required to connect to the internet first.

10 The psychotherapy conducted between the therapist and several clients may preferably be a two-way audio-video communication session. To achieve such object, the therapist computing device (102a) and the client computing devices (102b) may respectively be provided with at least a video camera to record an image of a person, a microphone to record sound of a person and a speaker to play audio to a person.

15

It may also be required to determine a baseline indication associated with the baseline state or initial state of each client at the beginning of the psychotherapy session. In order to determine the baseline indications, each of the clients may be invited and required by the baseline analysing module (108), at Step S305, to react to a plurality of questions displayed to the client on the client computing device (102b) or posed to the client by the therapist at the beginning of the psychotherapy session. The client's reactions in response to the questions may be captured and recorded by using the video camera and microphone provided to the client computing device (102b). The reactions to be captured and recorded may comprise the client's speeches, the client's body paralinguistic features (such as the client's facial expressions, eye movements, gestures and postures) and the client's vocal paralinguistic feature (such as the client's pitch, loudness or sound pressure, timbre and tone). The client's reactions may also be analysed by using the NLP module (104) and paralinguistic feature analysing module (106). Subsequently, based on the analyses performed by the NLP module (104) and the paralinguistic feature analysing module (106), a baseline score associated with the baseline state may be computed for each of the clients by the baseline analysing module (108), at Step S307.

Once the baseline indications are determined for each of the clients, the psychotherapy may be initiated, as at Step S309. During the psychotherapy session, the reactions of the therapist and each of the clients may be captured and recorded, as at Step S311 and

5 Step S321, using the video camera and microphone provided to the therapist computing device (102a) and the client computing devices (102b). The reactions to be captured and recorded may be one or more of the following: the therapist's speeches, the client's speeches, the therapist's body paralinguistic features (such as the therapist's facial expressions, eye movements, gestures and postures), the client's body paralinguistic

10 features (such as the client's facial expressions, eye movements, gestures and postures), the therapist's vocal paralinguistic features (such as the therapist's pitch, loudness or sound pressure, timbre and tone) and the client's vocal paralinguistic features (such as the client's pitch, loudness or sound pressure, timbre and tone). Depending on the reactions to be captured and recorded, the reactions may be recorded in the form of an

15 audio file or a video file.

If the reactions captured and recorded are the therapist's and the client's speeches, the reactions may be recorded in the form of an audio file. These audio files may then be transferred to the NLP module (104) which converts the speeches in the audio files to

20 text-based speech data, as at Step S313. Subsequently, at Step S315, the NLP module (104) may analyse the speech data to generate at least a first indication and a second indication for each of the clients participated in the psychotherapy session, wherein the first indication may be associated with a degree of verbal concordance between the therapist and a particular client, and the second indication may be associated with an

25 insight data in response to a specific therapist-client scenario. The NLP module (104) may also analyse the speech data to generate a fifth indication which may be associated with a degree of verbal concordance between the clients, such as between Client A₄ and B₄, between Client A₄ and Client C₄, between Client B₄ and Client C₄, etc.

30 Accordingly, it should be appreciated that multiple first, second and fifth indications may be generated, as more than one client is participated in the psychotherapy session. Furthermore, the same operations depicted in Embodiment 3 above may be performed

for obtaining the first and second indications for each of the clients participated in the psychotherapy session, while the fifth indications may be calculated and obtained using the same operations for obtaining the first indications.

- 5 If the reactions captured and recorded are the body and vocal paralinguistic features of each of the therapist and clients, the reactions may be recorded in the form of a video file. These video files may be transferred to the paralinguistic feature analysing module (106) which may convert the paralinguistic features contained in the video files to a plurality of paralinguistic data, as at Step S323, and analyse the paralinguistic data to
10 generate at least a third indication for each of the clients in the psychotherapy session, as at Step S325. The third indication may be associated with a psychological state of a particular client, wherein the psychological state may be a mental state (such as fatigue, sleepiness, concentration, etc.), emotional state (such as anger, fear, sadness, frustration, etc.), socio-emotional state (such as guilt, embarrassment, jealousy, etc.) or any
15 combination thereof. In certain exemplary embodiments, the psychological state may preferably be the concentration level of a particular client.

Additionally, the paralinguistic feature analysing module (106) may also analyse the paralinguistic data to generate a fourth indication and a sixth indication for each client
20 in the psychotherapy session. The fourth indication may be associated with a degree of non-verbal concordance between the therapist and a particular client, whereas the sixth indication may be associated with a degree of non-verbal concordance between a pair of clients participated in the psychotherapy session, such as between Client A₄ and B₄, between Client A₄ and Client C₄, between Client B₄ and Client C₄, etc.

25

Similarly, multiple third, fourth and sixth indications may be generated, as more than one client is participated in the psychotherapy session. The same operations described in Embodiment 3 above may also be performed to generate the third indication for each of the clients participated in the psychotherapy session.

30

The first, second, third, fourth, fifth, sixth and baseline indications may be subjected to further processing using the therapy assessment module (110), in order to enable more

meaningful and insightful assessment in relation to the psychotherapy session. For instance, upon processing the indications, the therapy assessment module (110) may determine one or more of the following for each client in the psychotherapy session: a first result in relation to the therapeutic relationship or alliance between the therapist and the client, based on the first and fourth indications; a second result in relation to the client's emotional valence score, based the second, third and baseline indications; a third result related to whether the client is honest or dishonest, based on the second and third indications; a fourth result related to whether the therapeutic approach is effective, based on the second indication; and a fifth result in relation to the therapeutic relationship between the client and another client, based on the fifth and sixth indications.

In some embodiments, after the psychotherapy session has ended, various information may be transmitted from the therapy assessment module (110) via the feedback module (130) to the therapist computing device (102a), as at Step S341 in Figure 6. It may then enable the therapist to review the information, as at Step 345, prior to uploading and storing them onto a database (120). The information to be reviewed at Step S345 may comprise the first indications, second indications, third indications, fourth indications, fifth indications, sixth indications, first results, second results, third results and fourth results.

In certain other embodiments, the feedback module (130) may transfer and display the indications and results to the therapist for viewing through a user interface on a display device of the therapist computing device (102a). Accordingly, it enables the therapist to review and provide feedbacks about the indications and results. During review, if the therapist does not detect any suspicious trends or have comments on the indications and results, the therapist may be requested to provide a confirmation input to the feedback module (130) through the user interface on the therapist computing device (102a). Upon the confirmation input, the feedback module (130) may generate a signal to the therapy assessment module (110), as at Step S351, notifying that the therapy assessment module (110) may upload all of the information to the database (120), as at Step S353.

In contrast, if the therapist detects suspicious trends on the indications and results during review, the therapist may provide a comment input comprising the therapist's comments on the detected suspicious trends to the feedback module (130) via the user interface on the therapist computing device (102a). Subsequently, the feedback module (130) may
5 convert the comment input to a plurality of comment data, so that they can be tagged to the corresponding indications or results, before uploading all of the information to the database (120).

Besides the indications and results, the text-based speech data may also be transmitted
10 from the NLP module (104) to the therapist computing device (102a) for review, via the feedback module (130), as at Steps S343 and S345 in Figure 6.

In particular, the feedback module (130) may transfer and display the text-based speech data to the therapist for viewing through the user interface on the therapist computing
15 device (102a). If the therapist identifies or detects errors in the text-based speech data, the therapist may provide a correction input through the user interface to correct the errors in the speech data. Later, the feedback module (130) may transfer the corrected speech data back to the NLP module (104), as at Step S351, thereby enabling the NLP module (104) to update the first, second and fifth indications based on the corrected
20 speech data, before transferring the indications to the therapy assessment module (108) to update the results and/or before uploading the latest information (e.g. the corrected speech data, updated indications and updated results) to the database (120), as at Step S353.

25 In contrast, if the therapist confirms that the text-based speech data do not require any corrections, the therapist may provide a confirmation input via the user interface on the therapist computing device (102a) to the feedback module (130). Upon receipt of the confirmation input, the feedback module (130) may generate and transmit a signal to the NLP module (104), as at Step S351, notifying that the NLP module (104) may
30 upload the originally generated data to the database (120), as at Step S353.

It should be appreciated that the first indications, second indications, third indications,

fourth indications, fifth indications, sixth indications, baseline indications, first results, second results, third results and fourth results may be expressed in term of scores. Accordingly, these scores may be provided and compared with ranges comprising a low range, a normal range and a high range. In some further embodiments, these ranges may
5 be updated periodically.

In some alternative embodiments, the methods described in the preceding description may be converted to a series of computer-executable program instructions stored on a non-transitory computer-readable storage medium. When the program instructions are
10 executed by either a computing device or a processing module of the computing device, it may cause the processing module to perform the steps or operation outlined above.

In some alternative embodiments, a computer program product comprising a computer useable or readable medium having a computer readable program may be provided. The
15 computer readable program, when executed on a computing device, may cause the computing device to perform the steps or operations outlined above.

The disclosure includes as contained in the appended claims, as well as that of the foregoing description. Although this invention has been described in its preferred form
20 with a degree of particularity, it is understood that the disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangements of parts may be resorted to without departing from the scope of the invention.

CLAIMS

1. A system for remotely conducting psychotherapy between a therapist provided with a therapist computing device (102a) and at least a client provided with a client
5 computing device (102b) comprising:

a Natural Language Processing (NLP) module (104) configured to convert the therapist's speeches and the client's speeches captured and recorded during a two-way audio-video communication session established between the computing devices (102a, 102b) to text-based speech data, and analyse the speech data to generate at least a first
10 indication associated with a degree of verbal concordance between the therapist and the client and a second indication associated with an insight data in response to a therapist-client scenario;

a paralinguistic feature analysing module (106) for converting the therapist's paralinguistic features and the client's paralinguistic features captured and recorded
15 during the communication session to a plurality of paralinguistic data, and analyse the paralinguistic data to generate at least a third indication associated with the client's psychological state and a fourth indication associated with a degree of non-verbal concordance between the therapist and the client; and

a therapy assessment module (110) in data communication with the NLP module
20 (104) and the paralinguistic feature analysing module (106);

wherein the therapy assessment module (110) is configured to receive the first indication, the second indication, the third indication and the fourth indication from the NLP module (104) and the paralinguistic feature analysing module (106), and assess the psychotherapy based on the received indications by determining at least:

25 a first result in relation to therapeutic relationship between the therapist and the client, based on the first indication and fourth indication;

a third result related to whether the client is honest or dishonest, based on the second indication and third indication; and

a fourth result related to whether a therapeutic approach is effective, based on
30 the second indication.

2. The system according to claim 1, wherein the first indication is generated by the

NLP module (104) based on function words identified upon comparing the therapist's speech data and the client's speech data using a Language Style Matching algorithm.

3. The system according to claim 1, wherein the second indication is generated by
5 the NLP module (104) based on one or more keywords identified from the speech data and upon comparison of the identified keywords to a list of insight conditions.

4. The system according to claim 1, wherein the paralinguistic features comprise
10 body paralinguistic features and vocal paralinguistic features.

5. The system according to claim 1 further comprising a baseline state analysing
module (108) configured to request for the client's reactions to a list of questions at the beginning of the psychotherapy, and determine a baseline indication associated with the client's baseline state based on the client's reactions.

15 6. The system according to claim 5, wherein the client's reactions comprise one or more of speeches, body paralinguistic features and vocal paralinguistic features.

7. The system according to claim 5, wherein the therapy assessment module (110)
20 is further configured to receive the baseline indication from the baseline state analysing module (108), and determine a second result in relation to the client's emotional valence score, based on the second indication, third indication and baseline indication.

8. The system according to claim 1, wherein if more than a client is present in the
25 psychotherapy, the NLP module (104) is further configured to generate a fifth indication associated with a degree of verbal concordance between any two of the clients, and the paralinguistic feature analysing module (106) is further configured to generate a sixth indication associated with a degree of non-verbal concordance between any two of the clients.

30 9. The system according to claim 8, wherein the therapy assessment module (110) is further configured to determine a fifth result in relation to the therapeutic relationship

between two clients, based on the fifth indication and sixth indication received from the NLP module (104) and paralinguistic feature analysing module (106) respectively.

10. The system according to any of the preceding claims, further comprising one or
5 more database (120) for storing a plurality of data received from the NLP module (104), paralinguistic feature analysing module (106), baseline state analysing module (108) and therapy assessment module (110) respectively.

11. The system according to any one of the preceding claims, further comprising a
10 feedback module (130) in data communication with the NLP module (104) and therapy assessment module (110), wherein the feedback module (130) is configured to:

display the text-based speech data received from the NLP module (104) through a user interface on a display device of the therapist computing device (102a), after the psychotherapy has ended;

15 receive a confirmation input through the user interface, if the speech data do not contain errors or require any corrections;

transmit a signal to the NLP module (104) after receiving the confirmation input, notifying the NLP module (104) to upload the speech data to a database (120);

20 receive a correction input to correct the speech data through the user interface, if the speech data contain errors and require corrections; and

transfer the corrected speech data to the NLP module (104), hence enabling the NLP module (104) to update the indications based on the corrected speech data, before transferring the updated indications to the therapy assessment module (110) to update the results and/or before uploading the updated indications and updated results to the
25 database (120).

12. The system according to claim 11, wherein the feedback module (130) is further configured to:

30 display the indications and results received from the therapy assessment module (108) through the user interface on the display device of the therapist computing device (102a), after the psychotherapy has ended;

receive a confirmation input through the user interface, if there are no suspicious

trends on the indications and results;

transmit a signal to the therapy assessment module (110) after receiving the confirmation input, notifying the therapy assessment module (110) to upload the indications and results to the database (120);

5 receive a comment input comprising comments on the suspicious trends through the user interface, if there are suspicious trends on the indications and results; and

convert the comment input to a plurality of comment data, so that the comment data can be tagged to the corresponding indications or results, before uploading the indications and results to the database (120).

10

13. The system according to any one of the preceding claims, wherein the therapist computing device (102a) and the client computing device (102b) are each provided with at least a video camera, a microphone and a speaker.

15 14. The system according to claim 13, wherein the video camera is configured to capture and record the body paralinguistic features, and the microphone is configured to capture and record the speeches and vocal paralinguistic features.

20 15. A method for remotely conducting psychotherapy between a therapist provided with a therapist computing device (102a) and at least a client provided with a client computing device (102b), the method comprising the steps of:

establishing a two-way audio-video communication session between the therapist computing device (102a) and the client computing device (102b), wherein the computing devices (102a, 102b) are each operatively coupled to the internet;

25 capturing the reactions of the therapist and the client during the communication session by the computing devices (102a, 102b), the reactions to be captured comprising one or more of speeches, body paralinguistic features and vocal paralinguistic features;

30 converting the captured speeches to text-based speech data by using a Natural Language Processing (NLP) module (104), if the speeches of the therapist and the client are captured;

analysing the text-based speech data by using the NLP module (104) to generate at least a first indication associated with a degree of verbal concordance between the

therapist and the client and a second indication associated with an insight data in response to a therapist-client scenario;

converting the captured paralinguistic features to a plurality of paralinguistic data by using a paralinguistic feature analysing module (106), if the paralinguistic features of the therapist and the client are captured;

analysing the paralinguistic data by using the paralinguistic feature analysing module (106), in order to generate at least a third indication associated with the client's psychological state of the client and a fourth indication associated with a degree of non-verbal concordance between the therapist and the client; and

assessing the psychotherapy based on the indications, by a therapy assessment module (110), to determine at least:

a first result in relation to therapeutic relationship between the therapist and the client, based on the first indication and fourth indication;

a third result related to whether the client is honest or dishonest, based on the second indication and third indication; and

a fourth result related to whether a therapeutic approach is effective, based on the second indication.

16. The method according to claim 14, wherein the first indication is generated by using the NLP module (104) based on function words identified upon comparing the therapist's speech data and the client's speech data using a Language Style Matching algorithm.

17. The method according to claim 14, wherein the second indication is generated using the NLP module (104) based on one or more keywords identified from the speech data and upon comparison of the identified keywords to a list of insight conditions.

18. The method according to claim 15 further comprising the steps of:
receiving the client's reactions to a plurality of questions provided to the client through the client computing device (102b) at the beginning of the psychotherapy; and
determining a baseline indication associated with the client's baseline state based on the client's reactions, by using a baseline state analysing module (108).

19. The method according to claim 18 further comprising the step of determining a second result in relation to the client's emotional valence score, based on the second indication, third indication and baseline indication, and by using the therapy assessment
5 module (110).

20. The method according to claim 15 further comprising the steps of generating a fifth indication associated with a degree of verbal concordance between two clients by using the NLP module (104), and generating a sixth indication associated with a degree
10 of non-verbal concordance between two clients by using the paralinguistic feature analysing module (106); wherein the steps of generating the fifth indication and sixth indication are performed if there is more than one client in the psychotherapy.

21. The method according to claim 20 further comprising the steps of determining
15 a fifth result in relation to the therapeutic relationship between two client based on the fifth indication and sixth indication and by using the therapy assessment module (110).

22. The method according to any of claims 15 to 21 further comprising the steps of storing a plurality of data received from the NLP module (104), paralinguistic feature
20 analysing module (106), baseline state analysing module (108) and therapy assessment module (110) respectively.

23. The method according to any of claims 15 to 22 further comprising the steps of:
displaying the text-based speech data received from the NLP module (104) via
25 a user interface on a display device of the therapist computing device (102a), after the psychotherapy has ended;

receiving a confirmation input by a feedback module (130) through the user interface, if the speech data do not contain errors or require corrections;

transmitting a signal from the feedback module (130) to the NLP module (104)
30 upon the confirmation input, notifying the NLP module (104) to upload the speech data to the database (120);

receiving a correction input by the feedback module (130) via the user interface

to correct the text-based speech data, if the speech data contain errors and require correction; and

transmitting the corrected speech data from the feedback module (130) to the NLP module (104), thereby allowing the NLP module (104) to update the indications
5 based on the corrected speech data, before transferring the indications to the therapy assessment module (110) to update the results generated and/or before uploading the updated indications and results to the database (120).

24. The method according to claim 23 further comprising the steps of:

10 displaying the indications and results received from the therapy assessment module (108) through the user interface on the display device of the therapist computing device (102a), after the psychotherapy has ended;

receiving a confirmation input by the feedback module (130) through the user interface, if there are no suspicious trends on the indications and results;

15 transmitting a signal from the feedback module (130) to the therapy assessment module (110) after receiving the confirmation input, notifying the therapy assessment module (110) to upload the indications and results to the database (120);

receiving a comment input comprising comments on the suspicious trends by the feedback module (130) through the user interface, if there are suspicious trends on
20 the indications and results; and

converting the comment input to a plurality of comment data using the feedback module (130), so that the comment data can be tagged to the corresponding indications or results, before uploading the indications and results to the database (120).

25 25. The method according to any of claims 15 to 24, wherein the computing devices (102a, 102b) are each provided with at least a video camera, a microphone and a speaker.

26. The method according to any of claims 15 to 25, wherein the steps of capturing
30 the therapist's reactions and the client's reactions are performed by using the video camera and microphone provided on the computing devices (102a, 102b).

27. A computer program comprising at least one instruction capable of being executed by a computing system which implements the method according to any of claims 15 to 25.
- 5 28. A non-transitory computer readable medium comprising the computer program according to claim 27.