

A SYSTEM AND METHOD FOR ANALYSING USER COMMUNICATION

TECHNICAL FIELD

5 The present invention relates to a system and method
for analysing user communication, and particularly,
although not exclusively, for analysing a digital stream of
a user communication so as to provide recommendations to
the user for improving their communication skills.

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BACKGROUND

Interactions and communications are essential aspects
of human behaviour which are constantly monitored by people
15 who are communicating with each other. In many settings of
human interaction, both verbal and non-verbal
communications delivered by an individual may convey a
significant amount of information about the individual as
well as their intention and background.

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Interviews, presentations, podcasts, broadcasts, public
speaking or other performances are often assessed not just
on the verbal expressions by those who are communicating
but also on body language and general behaviour of the
25 person in question. Unfortunately, whilst users may be
taught to improve their communication skills by reading or
watching lectures, significant improvements may only be
achieved where there is practice in front of suitably
trained observers and to receive their direct feedback.

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Therefore, in order to improving one's communications
skills, it is often required to find human instructors or
coaches. Unfortunately, finding such instructors or coaches
are difficult, expensive or time consuming.

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SUMMARY OF THE INVENTION

In accordance with a first aspect of the present invention, there is provided a system for analysing user communication comprising:

- 5 - a media gateway arranged to receive a communication stream, wherein the communication stream includes a user communication;
- a communication attributes analytical engine arranged to process the communication stream to identify one or more
- 10 communication attributes of the user communication; and,
- an attributes processor arranged to process the identified one or more communication attributes to determine
- a plurality of communication attribute scores, each arranged to represent a core communication benchmark associated with
- 15 user communications.

In an embodiment of the first aspect, the system further includes:

- a behaviour assessment module arranged to apply a
- 20 behaviour assessment model to the identified one or more communication attributes to determine a plurality of
- behaviour assessment scores associated with the user communication, wherein the plurality of behaviour
- assessment scores is arranged to represent a pre-determined
- 25 human observation of the user communication.

In an embodiment of the first aspect, the communication attributes analytical engine includes a facial expression and emotion detection engine arranged to process the

30 communication stream to identify one or more communication attributes associated with facial expressions and emotions expressed by the user within the user communication.

In an embodiment of the first aspect, the communication attributes analytical engine further includes a voice

35 processor arranged to extract the voice of the user and to

detect the one or more communication attributes associated with voice characteristics of the user's voice within the user communication, wherein the voice characteristics include pitch, speed and volume of the user's voice.

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In an embodiment of the first aspect, the communication attributes analytical engine further includes a body language processor arranged to detect one or more communication attributes associated with body movements of the user, level of body exposure of the user, hand gestures of the user, or any one or combination thereof.

In an embodiment of the first aspect, the communication attributes analytical engine further includes a text extraction module arranged to extract one or more communication attributes associated with the text of the user communication.

In an embodiment of the first aspect, the text of the user communication, the voice of the user or the voice characteristics of the user's voice is processed by a language assessment module to determine grammar correctness, pronunciation correctness, tone of speech correctness or any combination thereof.

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In an embodiment of the first aspect, the one or more communication attributes are processed by the attributes processor including a hierarchy scores processor to generate a plurality of communication attributes scores, wherein the hierarchy scores processor:

- prioritizes the one or more communication attributes into a hierarchy of attributes with a predefined attributes hierarchy;
- applies a predefined weight to each of the one or more communication attributes, wherein the predefined weights are determined based on a human observer's comparison of a

communication attribute with that of another communication attribute on the same level of the hierarchy; and,

- determines a plurality of communication attributes scores, with an overall score of a communication attribute at the top of the hierarchy and a plurality of sub scores of communication attributes on the lower levels of the hierarchy.

In an embodiment of the first aspect, the communication attributes are further processed with a behaviour assessment model to determine behaviour assessment scores, wherein the behaviour assessment scores include a confidence score, fluency score, credibility score, energy score, or any one or combination thereof.

In an embodiment of the first aspect, the communication attributes scores and the behaviour assessment scores are presented in a feedback report; and, wherein the feedback report further includes one or more recommendations as determined by the behaviour assessment scores.

In accordance with a second aspect of the present invention, there is provided a method for analysing user communication comprising the steps of:

- receiving a communication stream, wherein the communication stream includes a user communication;
- processing the communication stream to identify one or more communication attributes of the user communication; and,
- processing the identified one or more communication attributes to determine a plurality of communication attribute scores, each arranged to represent a core communication benchmark associated with user communications.

In an embodiment of the second aspect, the method further

includes the step of:

- applying a behaviour assessment model to the identified one or more communication attributes to determine a plurality of behaviour assessment scores associated with the user communication, wherein the plurality of behaviour assessment scores is arranged to represent a pre-determined human observation of the user communication.

In an embodiment of the second aspect, the communication attributes analytical engine includes a facial expression and emotion detection engine arranged to process the communication stream to identify one or more communication attributes associated with facial expressions and emotions expressed by the user within the user communication.

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In an embodiment of the second aspect, the communication attributes analytical engine further includes a voice processor arranged to extract the voice of the user and to detect the one or more communication attributes associated with voice characteristics of the user's voice within the user communication, wherein the voice characteristics include pitch, speed and volume of the user's voice.

In an embodiment of the second aspect, the communication attributes analytical engine further includes a body language processor arranged to detect one or more communication attributes associated with body movements of the user, level of body exposure of the user, hand gestures of the user, or any one or combination thereof.

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In an embodiment of the second aspect, the communication attributes analytical engine further includes a text extraction module arranged to extract one or more communication attributes associated with the text of the user communication.

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In an embodiment of the second aspect, the text of the user communication, the voice of the user or the voice characteristics of the user's voice is processed by a language assessment module to determine grammar correctness, pronunciation correctness, tone of speech correctness or any combination thereof.

In an embodiment of the second aspect, the one or more communication attributes are processed by the attributes processor having a hierarchy scores processor to generate a plurality of communication attributes scores, wherein the hierarchy scores processor:

- prioritizes the one or more communication attributes into a hierarchy of attributes with a predefined attributes hierarchy;

- applies a predefined weight to each of the one or more communication attributes, wherein the predefined weights are determined based on a human observer's comparison of a communication attribute with that of another communication attribute on the same level of the hierarchy; and,

- determines a plurality of communication attributes scores, with an overall score of a communication attribute at the top of the hierarchy and a plurality of sub scores of communication attributes on the lower levels of the hierarchy.

In an embodiment of the second aspect, the communication attributes are further processed with a behaviour assessment model to determine behaviour assessment scores, wherein the behaviour assessment scores include a confidence score, fluency score, credibility score, energy score, or any one or combination thereof.

In an embodiment of the second aspect, the communication attributes scores and the behaviour assessment scores are presented in a feedback report; and, wherein the feedback

report further includes one or more recommendations as determined by the behaviour assessment scores.

BRIEF DESCRIPTION OF THE DRAWINGS

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Embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings in which:

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Figure 1 is a schematic block diagram of a computer system arranged to be implemented to operate as a system for analysing user communication in accordance with one embodiment of the present invention;

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Figure 2 is a block diagram a system for analysing user communication as implemented by the computer of Figure 1;

Figure 3 is a block diagram of another embodiment of a system for analysing user communication;

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Figure 4 is a block diagram of an example communication attributes analytical engine of the system for analysing user communication of Figure 2 or 3;

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Figure 5 is a block diagram of an example behaviour assessment model of the system for analysing user communication in Figure 3;

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Figure 6A is an example screenshot of an interface of the system for analysing user communication in Figure 3;

Figure 6B is an example screenshot of an interface of the system for analysing user communication in Figure 3; and,

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Figure 6C is an example screenshot of an interface of the system for analysing user communication in Figure 3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

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Referring to Figure 1, an embodiment of a computer system 100 or computing device is arranged to be implemented to operate as, or provide, a system and method for analysing user communication comprising:

- 10 - a media gateway arranged to receive a communication stream, wherein the communication stream includes a user communication,
- a communication attributes analytical engine arranged to process the communication stream to identify one or more communication attributes of the user communication; and
- 15 - an attributes processor arranged to process the identified one or more communication attributes to determine a plurality of communication attribute scores, each arranged to represent a core communication benchmark associated with user communications.
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Preferably, the method and system may also be implemented on the computer system 100 to include a behaviour assessment module arranged to apply a behaviour assessment model to the identified one or more communication attributes to determine a plurality of behaviour assessment scores associated with the user communication, wherein the plurality of behaviour assessment scores is arranged to represent a pre-determined human observation of the user communication.

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In this example embodiment, the media gateway, communication attributes analytical engine, attributes processor and behaviour assessment module may be implemented by or on a computer having an appropriate user interface and processing functions. The computer may be implemented

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by any computing architecture, including portable computers, tablet computers, stand-alone Personal Computers (PCs), smart devices, Internet of Things (IOT) devices, edge computing devices, client/server architecture, "dumb" terminal/mainframe architecture, cloud-computing based architecture, or any other appropriate architecture. The computing device may be appropriately programmed to implement the invention.

10 In this embodiment, the system and method for analysing user communications is arranged to receive a media stream of a communication performance from a user and in turn, process the communication media stream or communication stream so as to identify any aspects of the user's communication performance, including any verbal and non-verbal communications, and analyse such communication aspects to produce user feedback for the user. In turn, allowing the user to assess and improve their own communication performance. Preferably, the system also includes a training service module which would suggest or direct the user to specific training packages or materials as based on the feedback results obtained from the analysis of the user's communication performance.

25 Example embodiments of the system for analysing user communications may be advantageous by offering an automated service to analyse a user's communication performance and to provide useful feedback for the user so as to improve the user's communication skills without, or minimize, the necessity of a human coach or instructor. The feedback may also be provided instantly and at any time and thus reduce the cost in communication skills education and training.

35 As shown in Figure 1, there is a shown a schematic diagram of a computer system or computer server 100 which is arranged to be implemented as an example embodiment of

a system for analysing user communication. In this embodiment, the computer system is a computer server or server 100 which includes suitable components necessary to receive, store and execute appropriate computer instructions. The components may include a processing unit 102, including Central Processing Unit (CPUs), Math Co-Processing Unit (Math Processor), Graphic Processing Unit (GPUs) or Tensor processing units (TPUs) for tensor or multi-dimensional array calculations or manipulation operations, read-only memory (ROM) 104, random access memory (RAM) 106, and input/output devices such as disk drives 108, input devices 110 such as an Ethernet port, a USB port, etc. Display 112 such as a liquid crystal display, a light emitting display or any other suitable display and communications links 114. The server 100 may include instructions that may be included in ROM 104, RAM 106 or disk drives 108 and may be executed by the processing unit 102. There may be provided a plurality of communication links 114 which may variously connect to one or more computing devices such as a server, personal computers, terminals, wireless or handheld computing devices, Internet of Things (IoT) devices, smart devices, edge computing devices. At least one of a plurality of communications link may be connected to an external computing network through a telephone line or other type of communications link.

The server 100 may include storage devices such as a disk drive 108 which may encompass solid state drives, hard disk drives, optical drives, magnetic tape drives or remote or cloud-based storage devices. The server 100 may use a single disk drive or multiple disk drives, or a remote storage service. The server 100 may also have a suitable operating system 116 which resides on the disk drive or in the ROM of the server 100.

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The computer or computing apparatus may also provide the necessary computational capabilities to operate or to interface with one or more machine learning networks, such as neural networks, to provide various functions and outputs. The neural networks may be implemented locally, or it may also be accessible or partially accessible via a server or cloud-based service. The machine learning networks may also be untrained, partially trained or fully trained, and/or may also be retrained, adapted or updated over time.

In this embodiment, the system for analysing user communication may be implemented to operate on a server or cloud service, and may be used by a user via an interface as provided on a user computing device such as, without limitation, a personal computer, tablet computer, laptop computer, smartphone, Internet of Thing (IoT) devices, edge computer devices, wearable devices or any computing or communication devices or systems. Preferably, the user may use the interface to record a communication performance and in turn, transmit this recording as a media stream to the system for analysing user communication so as to obtain a feedback report. The user may review this feedback report, and when desired, may repeat the recording and submission process to improve their respective communication skills.

With reference to Figure 2, there is illustrated an example embodiment of a system for analysing user communication 200 comprising: a media gateway 204 arranged to receive a communication stream 202, wherein the communication stream 202 includes a user communication, a communication attributes analytical engine 206 arranged to process the communication stream 202 to identify one or more communication attributes of the user communication; and an communication attributes processor (not shown in Figure 2) arranged to process the identified one or more communication attributes to determine a plurality of communication

attributes scores associated with core communication benchmarks representative of a class or type of user communications.

5 In this embodiment, a media stream 202 which would include a captured user communication performance may be firstly recorded by a user through a video camera and/or microphone arranged to capture the user's communication performance into the media stream 202. This media stream
10 202 may be a video and/or audio stream of the user undergoing an communication activity or performance including, but without limitation, a presentation, public speaking, interview, meeting, consultation, performance, or an act, song, prayer or recital. It is expected that all types of
15 human communications, including verbal, musical, non-verbal, action or any combination thereof, that may be captured in a media stream 202 may be suitable for processing by the examples of the system for analysing user communication 200 so as to provide feedback for the
20 communication attempts of the user.

 Once this communication media stream 202 is captured, it may be transmitted to the communication attributes analytical engine 206 via a media gateway 204 arranged to
25 receive the media stream 202 provided. Preferably, a user may use a computing device, including a portable computer, laptop computer, tablet computer, smart phone, Internet of Technologies (IoT) device, wearable, device or a combination of various multimedia equipment including camera or
30 microphone devices to capture the user undertaking the communication or performance. This media stream 202 is transmitted via a communication network or via an input/output device such that it may be received by the media gateway 204 which will in turn see that the media
35 stream 202 is processed by the communications attribute analytical engine 206.

In this embodiment, the engine 206 is arranged to process the media stream 202 and to identify any communication attribute that are representative of various characteristics, parameters and communication aspects relevant or associated with the quality of the communication performance by the user. In turn, by identifying these attributes, a further processing of these attributes may produce a set of communication attributes scores that would be an aggregation or summary of all of the detected and identified communication attributes. By identifying and detecting certain aspects and measuring the occurrence of certain detected communication attributes over the communication performance, a set of communication attributes scores may be detected, determined and compared with an existing predetermine set of rules, a learning network, or preferably a human simulating decision model arranged to simulate a decision making process by a human observer so as to provide a user feedback 208 to the user in order for the user to identify and understand the quality of their communication.

Once the user is able to obtain these communication attributes scores in the form of feedback 208 from the communication attributes analytical engine 206, the user may then be able to review the various quality of their communication and in turn provide an opportunity or guidance for the user to improve on their subsequent communication skills. Preferably, a training program 210 directly relevant to the user feedback 208 may be provided by the system 200 so as to provide targeted training for the user in their goal to improve their communication skills.

Embodiments of the system for analysing user communication 200 may be advantageous as users are able to improve upon their communication skills via the use of an

automated system. A user may in turn be able to capture a video and/or audio of a presentation, mock interview, or any other communication performances that they may deliver and in turn have an automated process provided by
5 embodiments of the system for analysing user communication so as to obtain the necessary feedback. Such a system is highly cost-effective and useful as it avoids the use of a human coach who may be costly or unsuitable as part of the training process. Embodiments of the present system allows
10 this process to be automated and provided in private and therefore both the user's identity and information conveyed in their performance may be confidential.

With reference to Figure 3, there is illustrated another
15 embodiment of a system for analysing user communication 300. In this embodiment, the system 300 includes a media gateway (not shown, as it may be integrated into the communication attribute analytical engine 206) and a communication attribute analytical engine 206 arranged to analyse a media
20 stream 202 received via the media gateway from a user. The engine 206, as described earlier with reference to Figure 2, may be arranged to process a media stream 202 of a user's communication performance so as to obtain a plurality of communication attributes associated with the various
25 characteristics and qualities of the user communication attempt.

Additionally, in this example of the system for analysing user communication, the system 300 further
30 includes a behaviour assessment model 310 arranged to process the communication attributes 308 so as to identify one or more specific behaviour assessment scores 312 that may represent an assessment of the communication performance as if the one or more human users had reviewed and assessed
35 the communication performance. These behaviour assessment scores 312 along with the communication attributes scores

308 may be presented to a user in a report 314 so as to provide the necessary feedback for the user's communication performance as presented in the media stream 202.

5 As shown in Figure 3, a user media stream 202 may firstly be received and processed by the communication attributes analytical engine 206 so as to obtain a set of communication attributes 308. In this embodiment, the analytical engine 206 is arranged to process the media stream frame by frame
10 or overtime to determine various attributes of the communications. These attributes may include, without limitations, both verbal and non-verbal aspects of human communications as captured in the media stream, and may include, without limitations:

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1. Facial Expressions and their respective Emotions, including:

- Happy
- Calm
- 20 - Surprised
- Confused
- Angry
- Disgusted
- Fear
- 25 - Sad

2. Voice patterns, including

- The Pitch of the user's voice
- The Volume of the user's voice
- 30 - The Speed in which the user speaks

3. Natural Language Expressions (Content), as expressed by the user (verbal)

- Positive text sentiment
- 35 - Negative text sentiment
- Neutral text sentiment

- Filler words detection
- Power phases detection

4. Body Languages, Movements and Gestures

- 5 - Body exposure
- Magnitude of movement of the body
- Magnitude of movement of the hand
- Magnitude of movement of head (x & y axis)
- Head shaking
- 10 - Eye contact
- Shoulder shrugging
- Palm (left hand, right hand)
- Fist (left hand, right hand)
- Cross hand (left hand, right hand)
- 15 - Thumb up (left hand, right hand)
- Swiping hand (left hand, right hand)
- Face touching
- Finger movements or gestures so as to detect specific hand gestures as represented by finger
- 20 formed gestures (hand signals or interaction of the fingers with other body parts).

These verbal and non-verbal aspects of the communication may be detected by processing the media stream of the user's communication performance by using specific image and sound processing modules to analysis the media stream over time, with such aspects detected as individual events that would represent the occurrence of these verbal and non-verbal aspects or characteristics of the user's communication over the course of the communication performance. In turn, these characteristics or aspects, once detected, are recorded as events which took place overtime in the communication performance. The communication attribute analytical engine may then proceed to aggregate or process these events so as to provide one or more communication attribute score, or may store these events for further processing to

identify specific behaviours or for behaviour assessments so as to provide further useful feedback to the user in the form of a user report 314. As it will be explained further below with reference to Figure 4, the communication attribute analytical engine 206 may firstly analyse the individual frames of the media stream which has recorded the user's communication for specific facial expressions, emotions, textual content, tone of voice and body language over the course of the communication performance. In turn, by tallying the events overtime and/or by use of a machine learning engine, or preferably, by use of a hierarchy scores processor that includes a decision model to emulate a human assessor's assessment criteria, the communication attributes 308 may be processed and be transformed into a set of communication attributes scores that would reflect the quality of the communication performance, and allow the user to quickly identify or summarise their strengths and weaknesses in their communication skills. These communication attribute scores may also represent a benchmark attribute which would be suitable for comparison amongst different communication performances.

As an example, the media stream 202 may be processed by the communications attribute analytical engine 206 by use of a facial expression detector which may include for example an image processing network specifically trained to detect facial expressions and in turn detect emotions of one or more persons captured in the video stream. In this example, the user, when communicating, may show specific facial expressions as part of their communication attempt. These facial expressions may be deliberate or they may be unintentional which would in turn reflect underlying stress or emotions of the user. Such emotions may be suitable for in certain situations but may not be suitable for other situations such as an interview and thus a determination of the emotions expressed during the communication performance

may then be events which are aggregated and processed to formulate a score to reflect the user's ability to control their emotion or use the correct facial expressions during the communication performance. Once this information is provided in a report, the user may then identify that during their communication performance, certain facial expressions are desirable whilst other expressions may not and in turn provide them with an opportunity to further improve the communication skills by controlling their emotions and the resultant facial expressions.

Similarly, the user's choice of words may be processed by natural language processing so as to determine whether suitable words are being used for any specific type of communication performance. As an example, padding words may reflect a lack of succinctness in the communication and that may be inappropriate in certain situations. In other situations, such as interviews, informal words detected may suggest the user is using inappropriate language in their communication and thus such events may be reflected as a score for the user's review.

The voice of the user during the communication may also be relevant as the speed, pitch or volume may reflect the suitability of the communication performance. These may also be measured by use of specific machine learning systems arranged to detect such attributes of a voice. These attributes may then be aggregated as a score as part of the user's feedback.

As it will be shown in Figure 4, the body language of the user may also be detected by processing the stream of images as provided in the communication stream. The body language of a user or presenter may affect the quality of the communication performance. Such body language may convey a sense of strength, credibility or confidence to an

observer and therefore may be highly relevant to any type of communication performance including interviews, public speaking, debates, speech conferences, press conferences. Accordingly, the communication attributes analytical engine 206 may use an image processing system to detect such body languages and flag these as events that are relevant to the communication performance.

Once the communication attributes 308 are captured by the communication attribute analytical engine 206, the attributes 308 may then be stored or further processed so as to provide a more in-depth user feedback to the user. As these attributes will include the detection of various events relevant to the verbal and non-verbal aspects of human communication, their aggregation or further processing after the communication performance may be provided as feedback to the user in the form of communication attributes scores that would reflect a summary of the quality of the communication performance. Furthermore, a behaviour assessment model 310 may also be used to process these communication attributes 308 so as to determine a behaviour assessment 312 of the performance that would represent an observation that may be made of the communication performance by a human assessor.

In one example, the behaviour assessment model 310 is arranged to model or simulate a human observer who may be observing and assessing the communication performance by analysing specific behaviour criteria's that may be deemed to be highly relevant for certain behaviours. Accordingly, a series of assessment factors as predetermined by human users may be utilised so as to identify these behaviours in the communication performance which may be used to devise a set of behaviour assessment scores 312. These factors may include a series of conditions that would model a specific type of behaviour and when such conditions are detected by

the communication attributes analytical engine 206, the behaviour assessment may be provided with a score 312 so as to reflect is the presence or intensity of such behaviour in the communication performance.

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As an example, such behaviours for assessment may include confidence, fluency, credibility or energy. A score is determined by communication attributes 308 relevant to each of these behaviours as obtained by analysing the communications attribute 308 with the behaviour assessment model 310 and in turn provide these behaviour scores 312 for the user as feedback in the form of a report 314. A further example of the behaviour assessment model of the behaviour scores will be described below in more detail with reference to Figure 5.

With reference to Figure 4, there is provided a detailed flow diagram to illustrate an example embodiment of the communication attribute analytical engine 206 as used in the system for analysing communication of Figure 2 or 3. In this embodiment, the media stream 202 is firstly processed by the communication attributes analytical engine 206 to detect a set of communication attributes 308 including verbal and non-verbal events that are reflective of the user communication. As illustrated in this embodiment, the communication attribute analytical engine 206 includes four specific detectors, extractors or processors (402, 404, 406 and 408) that are each arranged to extract specific verbal or non-verbal aspects of the user communication from the media stream 202.

Preferably, each of these detectors, extractors and processors (402, 404, 406 and 408) uses a learning engine such as a learning network or neural network specifically arranged to identify the necessary verbal or non-verbal aspect of human communication by processing the media stream

to identify these specific verbal or non-verbal aspects. These may include Artificial Intelligence (AI) tools that uses image processing systems, audio processing systems or natural language processing systems to identify specific verbal and non-verbal events of the communication stream that is being processed by the communication attributes analytical engine 206.

As shown, the communication attributes analytical engine 206 includes a facial and a motion detector 402 arranged to detect facial expressions in the communication performance and accordingly determine the emotions of the user via these facial expressions as detected in the communication performance. Once detected, these expressions and emotions are recorded as part of the raw or unprocessed communication attributes 308. Preferably, the facial emotion detector uses an image processing engine arranged to identify facial expressions. An example, of such facial and emotion analysis may be implemented with AWS Rekognition tools which may process a video of a user's communication performance and identify their facial expressions over the course of the communication performance and thus determine the various emotions of the user as well as the various facial expressions that they have expressed during the communication performance. These detected facial expression and emotion events may be stored as part of communication attribute scores and reflected in user feedback or for further processing to identify a human behaviour of the communication performance.

Preferably, the communication attributes analytical engine 206 also includes a text extractor 404 which is arranged to process the audio stream of the communication performance to extract the words that are spoken by the user in the communication performance. These words may then be processed with a natural language processing system so as

to identify specific words or the detection of the usage of filler words that would be a necessary in a communication performance, power phrases, the uses of complex jargon, confusing texts or phrases as well as a detection of the sentiment of the words it amused by the user that may reflect positive sentiment, negative sentiment or mutual sentiment. Such detections may also form as part of the communication attributes because for feedback of further processing. Examples of tools that may be used to implement this processing include Amazon Comprehend and Amazon Transcribe.

As shown in this example, the communication attribute analytical engine 206 also includes a voice processor 406 arranged to process or track the tone of voice of the user in the communication performance. In this example the user's communication performance may be assessed to identify the pitch of their voice, the volume of the voice or the speed in their speech. This may be implemented, for example by use of python packages (crepe and pyloudnorm) used as foundation as well as other propriety tools to detect the speed of speech, volume and pitch levels and variations during the video of the communication performance.

Preferably, a body language processor 408 is also provided in this example as part of the communication attribute analytical engine 206. Body language is a very powerful aspect of communication and may contribute substantially to the ability of the user in the communication. In this example embodiment, an image processing system may be used to detect body key points, levels of body exposure, hand gestures and movements. The body exposure area may be determined with the presenter's shoulders and the head movement in each frame to detect the amplitude of body movement. Preferably, the body language processor 408 may identify different movements including 'open arms', 'closed arms', 'head shake', 'head nod', 'eyes

contact', 'shoulder shrug', 'shoulder shake', 'hands movement', 'torso movement' and 'the body joint point directions'. These may be implemented by the following methods:

5 (a) Body key points

Using computer vision to detect the body in the video frame-by-frame and locate the key point of the body such as hand leg head etc

 (b) Body exposure

10 Using computer vision to detect the body in the video frame-by-frame and calculate the body exposure area Hand Detection and to identify different hand gestures including 'fist', 'palm', 'clenched hands and hands clasped', 'thumbs up', 'touching face'.

15 (c) Hand gesture

Using computer vision to detect the hands in the video frame-by-frame and classified the hand gesture by Machine Learning

20 Finger Detection: Identify different hand gestures with various finger positions including 'one', 'two', 'three', 'four', 'five', 'okay', etc.

Furthermore, by detecting hand detection and hand gestures, it is possible to use the body language processor
25 408 to identify specific types of movements or gestures which would be reflective of various types of behaviours or emotions of the user in the communication performance including open hands clenched hands clamped hands palms up and touching off face or hair. These body languages as body
30 language events may also be considered as part of the communication attribute scores 308 which may be used for further processing or as feedback to the user.

35 Preferably as shown in Figure 4, the text that has been extracted from the communication performance as well as the audio stream of the communication performance may be further

processed by a language assessment module 410 to determine the language capability of the user in their communication performance. In this example, the language assessment module 410 may consider the grammar 412 or sentence structure of the text used by the user in the communication to thereby determine the language capabilities of the user. The pronunciation 414 of specific words may also be assessed by analysing the voice data of the user as well as the pitch of voice 416 that is the tone of the speech by the communication by the user in the communication performance may also be tracked and determined as to determine whether the user a correct usage of pitch in the words that they have spoken. Accordingly, apart from improving the communication performance of the user, the language abilities of the user may also be assessed and provided as feedback. Tools which may be used to implement these functions may include, for example, Crepe, Youdou AI English grammar correction, Youdou AI Computer Assisted Pronunciation Training.

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As shown in Figure 5, there is provided a block diagram illustrating an example embodiment of a behaviour assessment model 500 arranged to determine a set of behaviour assessment scores (504, 506, 508, 510) and a hierarchy score processor 502 arranged to process the communication attribute 308 into communication attribute scores that would be a representative of a summary of all of the detected and recorded communication attributes 308. Preferably, the behaviour assessment scores 504, 506, 508, 510 are relevant to human observations of a communication performance and thus may represent a behaviour that may be observed by a human observer and may be a desirable behaviour in any communication performance.

35 In this example, these behaviour assessment scores are represented by one of four behaviours, including confidence

504, fluency 506, credibility 508 and energy 510. These behaviours scores are predetermined by a behaviour assessment model that may take the form of a set of rules as to when certain communication attributes or events that
5 have been detected over the time 512 in the communication performance. As an example:

Confidence 504: If the user is showing calm and happy for their facial expression, more positive content in
10 his/her speech, appropriated variation of voices and appropriated body movement and gestures, his/her confidence score will be high.

Fluency 506: User can gain good result in fluency if
15 he/she can keep their emotion in positive and stable voice pattern.

Credibility 508: Showing sincerity body gesture and affirmatory tone of voice can highly increase the
20 credibility. Also, using positive facial and content expression can be more reliable.

Energy 510: To have higher energy, the users need to use more body gestures and attractable voice pattern to
25 encourage the audiences. Positive facial and content expression are also important in this category.

In order to produce a behaviour score, events as provided in the communication attributes 308 relevant to
30 each of these behaviours may be measured for occurrence over time 512 of the communication performance. Once provided, the scores 504, 506, 508 and 510 may then trigger a recommendation with a recommendation generator 516 that would suggest ways in which the user may improve on these
35 scores. The generator 516 may identify specific recommendations from a database 518 that has been pre-

populated from various training guides useful to improve specific areas for improvements. Alternatively, a learning network 514, may be pre-trained to determine each of these behaviour assessments scores by classifying the communication attributes 308 to determine a score for each of these behaviour assessments.

Although the communication attributes 308 may already be useful to provide suitable feedback to the user, these scores 308 may be further processed so as to improve their usefulness in providing more accurate feedback to the user. In one example, a manner in which the communication attributes 308 may be processed may include the use of a decision model to replicate how a human observer may assess the observed attributes 308 to formulate an opinion or rating of the user's communication skills.

In order to replicate such a human observer, an Analytic Hierarchy Process (AHP) model may be created to replicate or simulate a human observer's assessment. A AHP model may take the form of various nodes which are placed into orders of priority to a specific goal, thus in this example, assuming that the various communication attributes are individual nodes, these nodes may be assessed by human observers of being of particular importance when compared with each other in pairs and in turn, this produces a priority of the important nodes being on top of the hierarchy with the lesser important nodes (attributes) being of layers below. These lesser important nodes, may be compared with each other by a human observer to produce a weight that can weight the consideration of each node of being more or less important when compared with each other in the overall goal. Accordingly, in this example, let's assume the overall goal is to deliver an excellent presentation, numerous human observers may be requested in a survey to determine which communication attributes are most

important, and how they are important when compared with another attributes, and in turn, this information may form a AHP calculation matrix that can be applied to the communication attributes as obtained here by the system.

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In this embodiment, a survey of human observers may firstly identify specific communication attributes and prioritize these into different levels of importance based on a hypothetical goal. One manner in which this can take place is by using the AHP method of comparing two different types of communication attributes and ask human observers to determine which of the two attributes, when compared together, is of more importance to a certain goal (e.g. a good interview, strong presentation etc) and asking for certain scores between the two attributes. In turn, this survey of human observers may be conducted on a large pool of observers and thus formulate a decision model that would provide weights and priorities to each of the communication attributes.

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As an example, lets assume an overall score is provided for the user of their communication performance, with further sub scores (nodes of lower levels) for their communication attributes of Emotion, Voice, Sentiment and Body, each of these attributes may be broken down into further sub nodes (sub attributes) which make up each of these attributes, such as:

Positive Emotion: Happy/Calm/Surprised
Negative Emotion: Sad/Angry/Confused/Disgusted/Fear
Sentiment: Positive Context/Negative Context
Voice: Speed/Volume/Pitch
Body Language: Head/Eye/Shoulders/Arms/Hands
(Palms)/Torso/Legs

Numerous human observers may be requested in a survey to compare each of these sub attributes together in order

of importance to the central goal, and thus a decision model may be formed from the collection of such comparisons based on their priority and comparison scores between each attribute when compared with each other. In turn, together
5 a decision model is made to determine the importance of when such attributes are detected within the communication performance of a user, and thus once calculated, an overall score may be formed along with scores for each of the communication attributes of Emotion, Voice, Sentiment and
10 Body. These may then be presented to the user as feedback in a report 520. Furthermore, the presentation of the report 520 may also trigger specific training programs that may be recommended to the user so as to improve the communication performance.

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In these examples, it may be advantageous to use such a hierarchy score process to transform the communication attributes 308 into communication attributes scores as this would provide a simple summary to the user in identifying
20 how they may improve their communication skills. Furthermore, by using a AHP model to capture human observer's opinions, the model would be able to model the assessment criteria of a skilled human assessor, and thereby provide an accurate human like decision making process for
25 users to judge their communication skills.

With reference to Figured 6A to 6C, there is illustrated a number of screenshots (6A, 6B and 6C) of example interfaces which may be used by users to access the system
30 for analysing communications 200, 300 so as to provide and obtain feedback of a user's communication performance. As shown in screenshot 6A, a user may firstly access the system and record a practice presentation or other types of communication performance.

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Preferably, the user may access the system for analysing user communication by use of a tablet computer, laptop or smart phone which already includes a camera and microphone and on the actuation of a record button, the user may then perform their performance 602 in front of the camera and microphone of the device. Once the user completes the communication performance, they may submit their presentation or communication performance for assessment. In some examples the user may select the type of communication performance which they are practising for including interviews, media presentations, public speaking or boardroom presentations or any other type of communication performance. By selecting these types of performances, a weighting may be applied on the communication attribute scores or on the behaviour assessment scores, or a different communication attributes scores processing model may be used (as determined by building a decision model based on different goals with AHP) when the communication performances is provided.

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Once the recording of the user's communication performance is uploaded to the system for analysing user communication, the system may be used to process this media stream with the communications attributes analytical engine. As described above with reference to Figure 3, 4 and 5, the communication attributes engine is arranged to process and identify verbal and non-verbal communication events which may then be used to provide a set of scores and behaviour assessment as feedback to the user.

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As shown in screenshot 6B, a score reflective of the emotion, voice, body or sentiment 604 of the user's communication performance is provided and thus provide immediate feedback to the user in how to improve upon each of these attributes. A graphical plot 606 may also be provided to illustrate the peaks and depressions of the

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performance so as to illustrate the strengths and weaknesses of their performance.

Furthermore, a series of behaviour assessment scores
5 608 which would be reflective of how a user may perceive
the behaviour of the communication performance is also
provided in Figure 6C and in turn an overall report may be
provided to the user so as to demonstrate to the user how
to improve on their communication skills. Recommendations
10 610 are also obtained from recommendations databased based
on the behaviour scores that may also be provided to the
user's direct feedback such that they may improve upon their
communication skills for their next communication
performance.

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Although not required, the embodiments described with
reference to the Figures can be implemented as an
application programming interface (API) or as a series of
libraries for use by a developer or can be included within
20 another software application, such as a terminal or personal
computer operating system or a portable computing device
operating system. Generally, as program modules include
routines, programs, objects, components and data files
assisting in the performance of particular functions, the
25 skilled person will understand that the functionality of
the software application may be distributed across a number
of routines, objects or components to achieve the same
functionality desired herein.

30 It will also be appreciated that where the methods and
systems of the present invention are either wholly
implemented by computing system or partly implemented by
computing systems then any appropriate computing system
architecture may be utilised. This will include stand alone
35 computers, network computers and dedicated hardware
devices. Where the terms "computing system" and "computing

device" are used, these terms are intended to cover any appropriate arrangement of computer hardware capable of implementing the function described.

5 It will be appreciated by persons skilled in the art that numerous variations and/or modifications may be made to the invention as shown in the specific embodiments without departing from the spirit or scope of the invention as broadly described. The present embodiments are,
10 therefore, to be considered in all respects as illustrative and not restrictive.

 Any reference to prior art contained herein is not to be taken as an admission that the information is common
15 general knowledge, unless otherwise indicated.

CLAIMS:

1. A system for analysing user communication comprising:
 - a media gateway arranged to receive a communication stream, wherein the communication stream includes a user communication;
 - a communication attributes analytical engine arranged to process the communication stream to identify one or more communication attributes of the user communication; and,
 - an attributes processor arranged to process the identified one or more communication attributes to determine a plurality of communication attribute scores, each arranged to represent a core communication benchmark associated with user communications.
2. A system for analysing user communication in accordance with claim 1, further including:
 - a behaviour assessment module arranged to apply a behaviour assessment model to the identified one or more communication attributes to determine a plurality of behaviour assessment scores associated with the user communication, wherein the plurality of behaviour assessment scores is arranged to represent a pre-determined human observation of the user communication.
3. A system for analysing user communication in accordance with claim 2, wherein the communication attributes analytical engine includes a facial expression and emotion detection engine arranged to process the communication stream to identify one or more communication attributes associated with facial expressions and emotions expressed by the user within the user communication.
4. A system for analysing user communication in accordance with claim 3, wherein the communication attributes analytical engine further includes a voice processor

arranged to extract the voice of the user and to detect the one or more communication attributes associated with voice characteristics of the user's voice within the user communication, wherein the voice characteristics include
5 pitch, speed and volume of the user's voice.

5. A system for analysing user communication in accordance with claim 4, wherein the communication attributes analytical engine further includes a body language processor
10 arranged to detect one or more communication attributes associated with body movements of the user, level of body exposure of the user, hand gestures of the user, or any one or combination thereof.

15 6. A system for analysing user communication in accordance with claim 5, wherein the communication attributes analytical engine further includes a text extraction module arranged to extract one or more communication attributes associated with the text of the user communication.

20 7. A system for analysing user communication in accordance with claim 6, wherein the text of the user communication, the voice of the user or the voice characteristics of the user's voice is processed by a language assessment module
25 to determine grammar correctness, pronunciation correctness, tone of speech correctness or any combination thereof.

8. A system for analysing user communication in accordance
30 with claim 7, wherein the one or more communication attributes are processed by the attributes processor including a hierarchy scores processor to generate a plurality of communication attributes scores, wherein the hierarchy scores processor:

35 - prioritizes the one or more communication attributes into a hierarchy of attributes with a predefined attributes

hierarchy;

- applies a predefined weight to each of the one or more communication attributes, wherein the predefined weights are determined based on a human observer's comparison of a communication attribute with that of another communication attribute on the same level of the hierarchy; and,
- determines a plurality of communication attributes scores, with an overall score of a communication attribute at the top of the hierarchy and a plurality of sub scores of communication attributes on the lower levels of the hierarchy.

9. A system for analysing user communication in accordance with claim 8, wherein the communication attributes are further processed with a behaviour assessment model to determine behaviour assessment scores, wherein the behaviour assessment scores include a confidence score, fluency score, credibility score, energy score, or any one or combination thereof.

10. A system for analysing user communication in accordance with claim 9, wherein the communication attributes scores and the behaviour assessment scores are presented in a feedback report; and, wherein the feedback report further includes one or more recommendations as determined by the behaviour assessment scores.

11. A method for analysing user communication comprising the steps of:

- receiving a communication stream, wherein the communication stream includes a user communication;
- processing the communication stream to identify one or more communication attributes of the user communication; and,
- processing the identified one or more communication attributes to determine a plurality of communication

attribute scores, each arranged to represent a core communication benchmark associated with user communications.

5 12. A method for analysing user communication in accordance with claim 11, further including the step of:
- applying a behaviour assessment model to the identified one or more communication attributes to determine a plurality of behaviour assessment scores associated with
10 the user communication, wherein the plurality of behaviour assessment scores is arranged to represent a pre-determined human observation of the user communication.

13. A method for analysing user communication in accordance
15 with claim 12, wherein the communication attributes analytical engine includes a facial expression and emotion detection engine arranged to process the communication stream to identify one or more communication attributes associated with facial expressions and emotions expressed
20 by the user within the user communication.

14. A method for analysing user communication in accordance with claim 13, wherein the communication attributes analytical engine further includes a voice processor
25 arranged to extract the voice of the user and to detect the one or more communication attributes associated with voice characteristics of the user's voice within the user communication, wherein the voice characteristics include pitch, speed and volume of the user's voice.

30 15. A method for analysing user communication in accordance with claim 14, wherein the communication attributes analytical engine further includes a body language processor arranged to detect one or more communication attributes
35 associated with body movements of the user, level of body exposure of the user, hand gestures of the user, or any one

or combination thereof.

16. A method for analysing user communication in accordance with claim 15, wherein the communication attributes analytical engine further includes a text extraction module arranged to extract one or more communication attributes associated with the text of the user communication.

17. A method for analysing user communication in accordance with claim 16, wherein the text of the user communication, the voice of the user or the voice characteristics of the user's voice is processed by a language assessment module to determine grammar correctness, pronunciation correctness, tone of speech correctness or any combination thereof.

18. A method for analysing user communication in accordance with claim 17, wherein the one or more communication attributes are processed by the attributes processor having a hierarchy scores processor to generate a plurality of communication attributes scores, wherein the hierarchy scores processor:

- prioritizes the one or more communication attributes into a hierarchy of attributes with a predefined attributes hierarchy;
- applies a predefined weight to each of the one or more communication attributes, wherein the predefined weights are determined based on a human observer's comparison of a communication attribute with that of another communication attribute on the same level of the hierarchy; and,
- determines a plurality of communication attributes scores, with an overall score of a communication attribute at the top of the hierarchy and a plurality of sub scores of communication attributes on the lower levels of the hierarchy.

19. A method for analysing user communication in accordance with claim 18, wherein the communication attributes are further processed with a behaviour assessment model to determine behaviour assessment scores, wherein the
5 behaviour assessment scores include a confidence score, fluency score, credibility score, energy score, or any one or combination thereof.

20. A method for analysing user communication in accordance with claim 19, wherein the communication attributes scores and the behaviour assessment scores are presented in a
10 feedback report; and, wherein the feedback report further includes one or more recommendations as determined by the behaviour assessment scores.

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