CLAIMS

What is claimed is:

1. A server comprising:

a memory including an input profile record repository; and

an electronic processor in communication with the memory, the electronic processor configured to

receive a plurality of historical input profile records (IPRs) associated with a first user using a first user interface of a first one or more computing devices, each of the plurality of historical IPRs based on a first plurality of user inputs and indicative of an identity of the first user, wherein the first plurality of user inputs is user inputs of a first password entered on a first layout of the first user interface, and wherein each user input of the user inputs includes a key up event and a key down event of each key in the first password relative to the first layout of the first user interface,

control the memory to store the plurality of historical IPRs in the input profile record repository,

receive a current IPR associated with a second user using a second user interface of a second computing device, the current IPR based on a second plurality of user inputs and indicative of an identity of the second user, wherein the second plurality of user inputs is a second password entered on a second layout of the second user interface, and wherein each user input of the second plurality of user inputs includes a key up event and a key down event of each key in the second password relative to the second layout of the second user interface,

generate, with a biometric identification algorithm, a first one or more biometric features based on the plurality of historical IPRs stored in the memory and a second one or more biometric features based on the current IPR,

determine whether the second user is the first user by comparing the first one or more biometric features and the second one or more biometric features to each other, and

responsive to determining that the second user is the first user, output an identity confirmation that the second user is the first user,

wherein the second computing device is separate and distinct from the first one or more computing devices,

wherein the second user interface is separate and distinct from the first user interface,

wherein the second layout is different from the first layout, and

wherein, to generate, with the biometric identification algorithm, the first one or more biometric features based on the plurality of historical IPRs and the second one or more biometric features based on the current IPR, the electronic processor is further configured to

determine a first one or more latencies of specific pairs of keys based on the plurality of historical IPRs,

determine a second one or more latencies of the specific pairs of keys based on the current IPR,

determine a first one or more latencies of first distance categories based on the plurality of historical IPRs,

determine a second one or more latencies of the first distance categories based on the current IPR,

determine a first one or more latencies of second distance categories based on the plurality of historical IPRs, and

determine a second one or more latencies of the second distance categories based on the current IPR.

2. The server of claim 1, wherein, to determine whether the second user is the first user by comparing the first one or more biometric features and the second one or more biometric features to each other, the electronic processor is further configured to

generate, with the biometric identification algorithm, a biometric score based on difference between the second one or more biometric features and the first one or more biometric features,

determine whether the biometric score is less than a lower threshold,

determine whether the biometric score greater than the lower threshold and less than an upper threshold, and

determine whether the biometric score is greater than the lower threshold and the upper threshold, and

wherein the second user is determined to be the first user in response to determining that the biometric score is greater than the lower threshold and the upper threshold.

3. The server of claim 2, wherein the second user is determined to not be the first user in response to determining that the biometric score is lower than the lower threshold and the upper threshold, and wherein the second user is undetermined relative to the first user in response to determining that the biometric score is higher than the lower threshold and lower than the upper threshold.

4. The server claim 1, wherein the plurality of historical IPRs and the current IPR each include an IPR header and a plurality of IPR events, wherein the plurality of IPR events includes a plurality of key down events and a plurality of key up events, and wherein the first password is a one-time-password (OTP).

5. The server of claim 1, wherein the plurality of historical IPRs and the current IPR each include an IPR header and a plurality of IPR events, and wherein the plurality of IPR events includes two or more of:

a form state event,
a form field focus event,
a form field blur event,
a key down event,
a key up event,
a mouse move event,
a mouse click event,
a touch event,
an accelerometer event,
a form submit event,
a total keys event,
a scroll position event,
a control list event,
a time sync event,
a mouse movement sample event,
a device motion sample event,
a device motion event,
a stop event, and

a truncate event.

6. The server of claim 1, wherein the first one or more biometric features and the second one or more biometric features each include a plurality of sensor features including two or more of:

average sensor value for each axis,

median sensor value for the each axis,

mean to median sensor value ratio for the each axis,

standard deviation of sensor values for the each axis,

coefficient of variation of sensor values for the each axis,

average absolute difference between sensor readings and the mean for the each axis,

interquartile range sensor value for the each axis,

an average of a square root of a sum of a square of x, y, z axis values,

binned distribution for the each axis,

number of peaks for the each axis normalized by total session time,

difference between maximum and minimum peak values for the each axis,

average peak value for the each axis, and

average time between the peaks for the each axis.

7. A method for user identification, the method comprising:

receiving, with an electronic processor, a plurality of historical input profile records (IPRs) associated with a first user using a first user interface of a first one or more computing devices, each of the plurality of historical IPRs based on a first plurality of user inputs and indicative of an identity of the first user, wherein the first plurality of user inputs is user inputs of a first password entered on a first layout of the first user interface, and wherein each user input of the user inputs includes a key up event and a key down event of each key in the first password relative to the first layout of the first user interface;

controlling, with the electronic processor, a memory to store the plurality of historical IPRs in an input profile record repository;

receiving, with the electronic processor, a current IPR associated with a second user using a second user interface of a second computing device, the current IPR based on a second plurality of user inputs and indicative of an identity of the second user, wherein the second plurality of user inputs is a second password entered on a second layout of the second user interface, and wherein each user input of the second plurality of user inputs includes a

key up event and a key down event of each key in the second password relative to the second layout of the second user interface;

generating, with the electronic processor and a biometric identification algorithm, a first one or more biometric features based on the plurality of historical IPRs stored in the memory and a second one or more biometric features based on the current IPR;

determining, with the electronic processor, whether the second user is the first user by comparing the first one or more biometric features and the second one or more biometric features; and

responsive to determining that the second user is the first user, outputting, with the electronic processor, an identity confirmation that the second user is the first user,

wherein the second computing device is separate and distinct from the first one or more computing devices,

wherein the second user interface is separate and distinct from the first user interface,

wherein the second layout is different from the first layout,

wherein, generating, with the biometric identification algorithm, the first one or more biometric features based on the plurality of historical IPRs and the second one or more biometric features based on the current IPR includes

determine a first one or more latencies of specific pairs of keys based on the plurality of historical IPRs,

determine a second one or more latencies of the specific pairs of keys based on the current IPR,

determine a first one or more latencies of first distance categories based on the plurality of historical IPRs,

determine a second one or more latencies of the first distance categories based on the current IPR,

determine a first one or more latencies of second distance categories based on the plurality of historical IPRs, and

determine a second one or more latencies of the second distance categories based on the current IPR.

8. The method of claim 7, wherein determining whether the second user is the first user by comparing the first one or more biometric features and the second one or more biometric features includes

generating, with the biometric identification algorithm, a biometric score based on difference between the second one or more biometric features and the first one or more biometric features,

determining whether the biometric score is less than a lower threshold,

determining whether the biometric score greater than the lower threshold and less than an upper threshold, and

determining whether the biometric score is greater than the lower threshold and the upper threshold, and

wherein the second user is determined to be the first user in response to determining that the biometric score is greater than the lower threshold and the upper threshold.

9. The method of claim 8, wherein the second user is determined to not be the first user in response to determining that the biometric score is lower than the lower threshold and the upper threshold, and wherein the second user is undetermined relative to the first user in response to determining that the biometric score is higher than the lower threshold and lower than the upper threshold.

10. The method claim 7, wherein the plurality of historical IPRs and the current IPR each include an IPR header and a plurality of IPR events, wherein the plurality of IPR events includes a plurality of key down events and a plurality of key up event, wherein the first password is a one-time-password (OTP).

11. The method of claim 7, wherein the plurality of historical IPRs and the current IPR each include an IPR header and a plurality of IPR events, and wherein the plurality of IPR events includes two or more of:

a form state event,

a form field focus event,

a form field blur event,

a key down event,

a key up event,

a mouse move event,

a mouse click event,

a touch event,

an accelerometer event,

a form submit event,
a total keys event,
a scroll position event,
a control list event,
a time sync event,
a mouse movement sample event,
a device motion sample event,
a device motion event,
a stop event, and
a truncate event.

12. The method of 7, wherein the first one or more biometric features and the second one or more biometric features each include a plurality of sensor features including two or more of:

average sensor value for each axis,
median sensor value for the each axis,
mean to median sensor value ratio for the each axis,
standard deviation of sensor values for the each axis,
coefficient of variation of sensor values for the each axis,
average absolute difference between sensor readings and the mean for the each axis,
interquartile range sensor value for the each axis,
an average of a square root of a sum of a square of x, y, z axis values,
binned distribution for the each axis,
number of peaks for the each axis normalized by total session time,
difference between maximum and minimum peak values for the each axis,
average peak value for the each axis, and
average time between the peaks for the each axis.

13. A system comprising:

a user interface device configured to output a plurality of historical input profile records (IPRs) associated with a first user using a first user interface of the user interface device, each of the plurality of historical IPRs based on a first plurality of user inputs and indicative of an identity of the first user, wherein the first plurality of user inputs is user inputs of a first password entered on a first layout of the first user interface, and wherein each

user input of the user inputs includes a key up event and a key down event of each key in the first password relative to the first layout of the first user interface; and

a server including

a memory including an input profile record repository; and

an electronic processor in communication with the memory, the electronic processor configured to

receive the plurality of historical IPRs,

control the memory to store the plurality of historical IPRs in the input profile record repository,

receive a current IPR associated with a second user using a second user interface of a second computing device, the current IPR based on a second plurality of user inputs and indicative of an identity of the second user, wherein the second plurality of user inputs is a second password entered on a second layout of the second user interface, and wherein each user input of the second plurality of user inputs includes a key up event and a key down event of each key in the second password relative to the second layout of the second user interface,

generate, with a biometric identification algorithm, a first one or more biometric features based on the plurality of historical IPRs stored in the memory and a second one or more biometric features based on the current IPR,

determine whether the second user is the first user by comparing the first one or more biometric features and the second one or more biometric features, and

responsive to determining that the second user is the first user, output an identity confirmation that the second user is the first user,

wherein the second computing device is separate and distinct from the user interface device,

wherein the second user interface is separate and distinct from the first user interface,

wherein the second layout is different from the first layout, and

wherein, to generate, with the biometric identification algorithm, the first one or more biometric features based on the plurality of historical IPRs

and the second one or more biometric features based on the current IPR, the electronic processor is further configured to

determine a first one or more latencies of specific pairs of keys based on the plurality of historical IPRs,

determine a second one or more latencies of the specific pairs of keys based on the current IPR,

determine a first one or more latencies of first distance categories based on the plurality of historical IPRs,

determine a second one or more latencies of the first distance categories based on the current IPR,

determine a first one or more latencies of second distance categories based on the plurality of historical IPRs, and

determine a second one or more latencies of the second distance categories based on the current IPR.

14. The system of claim 13, wherein, to determine whether the second user is the first user by comparing the first one or more biometric features and the second one or more biometric features, the electronic processor is further configured to

generate, with the biometric identification algorithm, a biometric score based on difference between the second one or more biometric features and the first one or more biometric features,

determine whether the biometric score is less than a lower threshold,

determine whether the biometric score greater than the lower threshold and less than an upper threshold, and

determine whether the biometric score is greater than the lower threshold and the upper threshold, and

wherein the second user is determined to be the first user in response to determining that the biometric score is greater than the lower threshold and the upper threshold.

15. The system of claim 14, wherein the second user is determined to not be the first user in response to determining that the biometric score is lower than the lower threshold and the upper threshold, and wherein the second user is undetermined relative to the first user in response to determining that the biometric score is higher than the lower threshold and lower than the upper threshold.

16. The system of claim 13, wherein the plurality of historical IPRs and the current IPR each include an IPR header and a plurality of IPR events, wherein the plurality of IPR events includes a plurality of key down events and a plurality of key up events, wherein the first password is a one-time-password (OTP).

17. The system of claim 13, wherein the plurality of historical IPRs and the current IPR each include an IPR header and a plurality of IPR events, and wherein the plurality of IPR events includes two or more of:

a form state event,
a form field focus event,
a form field blur event,
a key down event,
a key up event,
a mouse move event,
a mouse click event,
a touch event,
an accelerometer event,
a form submit event,
a total keys event,
a scroll position event,
a control list event,
a time sync event,
a mouse movement sample event,
a device motion sample event,
a device motion event,
a stop event, and
a truncate event.

18. The system of claim 13, wherein the first user interface is one of a first physical user interface or a first virtual user interface, wherein the second user interface is one of a second physical user interface or a second virtual user interface, wherein, when the second user interface is the second virtual user interface, the first user interface is the first physical user

interface, and wherein, when the second user interface is the second physical user interface, the first user interface is the first virtual user interface.

19. The server of claim 1, wherein the first user interface is one of a first physical user interface or a first virtual user interface, wherein the second user interface is one of a second physical user interface or a second virtual user interface, wherein, when the second user interface is the second virtual user interface, the first user interface is the first physical user interface, and wherein, when the second user interface is the second physical user interface, the first user interface is the first virtual user interface.

20. The method of claim 7, wherein the first user interface is one of a first physical user interface or a first virtual user interface, wherein the second user interface is one of a second physical user interface or a second virtual user interface, wherein, when the second user interface is the second virtual user interface, the first user interface is the first physical user interface, and wherein, when the second user interface is the second physical user interface, the first user interface is the first virtual user interface.