

each of a plurality of evenly distributed feature points, at regular spatial intervals, in the handwriting test sample; performing first feature matching between geometric features of the handwriting test sample and geometric features of a reference sample; determining a handwriting verification result based at least in part on the feature matching; and outputting the handwriting verification result. The geometric features may further comprise values derived from the geometric parameters, such as direction and curvature values. The determining of the handwriting verification result can be further based on a count of unlinked feature points.

[0006] The first feature matching can include finding mappings between one or more of the evenly distributed feature points in the test sample and one or more evenly distributed feature points in the reference sample. The first feature matching can include a simulated annealing process. The simulated annealing process can include selecting a feature point in the reference sample; generating a pseudo-random value; comparing the pseudo-random value with a constant; and based on the comparing, determining whether to remove a link from a selected point in the reference sample or define a new link between the selected feature point in the reference sample and a selected feature point in the test sample. The determining step can be biased towards defining a new link over removing an existing link based on the value of the constant. If a new link is defined, any previously existing links that are crossed by the new link can be removed.

[0007] Second feature matching also can be performed, which may include evaluation of a non-geometric parameter (e.g., a time-related parameter, such as speed, acceleration, or pen pressure over time). The second feature matching may include comparing an area of a pressure-time diagram from a start point of the reference sample to an i^{th} point of the reference sample and an area of a pressure-time diagram from a start point of the test sample to an i^{th} point of the test sample. The handwriting verification result can be further based on the second feature matching.

[0008] In another aspect, a handwriting verification method comprises performing feature matching between geometric features of a handwriting test sample and geometric features of a reference sample, wherein the feature matching comprises defining one or more links between one or more evenly distributed feature points in the test sample and one or more evenly distributed feature points in the reference sample; obtaining a count of consecutive unlinked feature points in the test sample; and outputting a handwriting verification result, wherein the handwriting verification result is based at least in part on the feature matching and the count of consecutive unlinked feature points in the test sample.

[0009] In another aspect, a user authentication method comprises receiving test signature data and a user device identifier (ID) from a user device; searching for a name ID associated with the test signature data; obtaining the name ID; searching for a reference

CLAIMS

1. A handwriting verification method executed in a computer system, the method comprising:

obtaining a handwriting test sample containing a plurality of available parameters, wherein the plurality of available parameters comprises geometric parameters and one or more non-geometric parameters;

extracting the geometric parameters from the plurality of available parameters;

based on the geometric parameters, deriving geometric features comprising an x-position value and a y-position value for each of a plurality of evenly distributed feature points, at regular spatial intervals, in the handwriting test sample;

performing first feature matching between geometric features of the handwriting test sample and geometric features of a reference sample;

determining a handwriting verification result based at least in part on the feature matching; and

outputting the handwriting verification result.

2. The method of Claim 1, wherein the first feature matching comprises finding mappings between one or more of the evenly distributed feature points in the test sample and one or more evenly distributed feature points in the reference sample.

3. The method of Claim 2, wherein the determining of the handwriting verification result is further based on a count of unlinked feature points.

4. The method of Claim 2, wherein the first feature matching comprises a simulated annealing process, and wherein the simulated annealing process comprises:

defining a new link between a selected feature point in the reference sample and a selected feature point in the test sample; and

removing any previously existing links that are crossed by the new link.

5. The method of Claim 2, wherein the first feature matching comprises a simulated annealing process, and wherein the simulated annealing process comprises:

selecting a feature point in the reference sample;

generating a pseudo-random value;

comparing the pseudo-random value with a constant; and

based on the comparing, determining whether to (a) remove a link from a selected point in the reference sample, or (b) define a new link between the selected feature point in the reference sample and a selected feature point in the test sample.

6. The method of Claim 5, wherein the determining step is biased towards defining a new link over removing an existing link based on the value of the constant.

7. The method of Claim 1, wherein the geometric features further comprise values derived from the geometric parameters, and wherein the values comprise direction and curvature values.

8. The method of Claim 1, further comprising second feature matching comprising evaluation of a non-geometric parameter, wherein the handwriting verification result is further based on the second feature matching.

9. The method of Claim 8, wherein the non-geometric parameter comprises a time-related parameter that includes at least one of speed, acceleration or pen-pressure value.

10. The method of Claim 9, wherein the time-related parameter comprises a pen-pressure value, and wherein the second feature matching further comprises comparing an area of a pressure-time diagram from a start point of the reference sample to an i^{th} point of the reference sample and an area of a pressure-time diagram from a start point of the test sample to an i^{th} point of the test sample.