

comprises the steps of: receiving an image of a facial region of a user, the facial region including an eye and an area surrounding the eye; processing the image to define an ocular image region including at least a portion of the eye in the image of the facial region; defining a plurality of periocular image regions each including at least a portion of the area surrounding the eye in the image of the facial region, wherein the periocular regions are defined based on dimensions of the defined ocular region; calculating one or more biometric match scores based on the ocular image region and at least one of the periocular regions; and designating the image of the facial region as authentic or not authentic based on the one or more biometric match scores.

An aspect of the present invention provides computer-implemented method comprising: receiving an image of a facial region of a user, the facial region including an eye and an area surrounding the eye; defining an ocular image region including at least a portion of the eye in the image of the facial region; defining one or more periocular image regions each including at least a portion of the area surrounding the eye in the image of the facial region; ranking the periocular image regions based on respective quality metrics separately calculated for each of the periocular image regions; identifying a plurality of points of interest in at least one of the ocular image region and the one or more periocular image regions; calculating, for each point of interest, a region value for texture surrounding the point of interest; and determining at least one quality metric for at least a portion of the image of the facial region based on the points of interest and the respective calculated region values.

Another aspect of the present invention provides a system comprising: at least one memory for storing computer-executable instructions; and at least one processing unit for executing the instructions stored on the at least one memory, wherein execution of the instructions programs the at least one processing unit to perform operations comprising: receiving an image of a facial region of a user, the facial region including an eye and an area surrounding the eye; defining an ocular image region including at least a portion of the eye in the image of the facial region; defining one or more periocular image regions each including at least a portion of the area surrounding the eye in the image of the facial region; ranking the periocular image regions based on respective quality metrics separately calculated for each of the periocular image regions; identifying a plurality of points of interest in at least one of the ocular image region and the one or more periocular image regions; calculating, for each point of interest, a region value for texture surrounding the point of interest; and determining at

least one quality metric for at least a portion of the image of the facial region based on the points of interest and the respective calculated region values.

Another aspect of the present invention provides a computer-implemented method comprising: receiving an image of a facial region of a user, the facial region including an eye and an area surrounding the eye; defining an ocular image region including at least a portion of the eye in the image of the facial region; defining one or more periocular image regions each including at least a portion of the area surrounding the eye in the image of the facial region; identifying a plurality of points of interest in at least one of the ocular image region and the one or more periocular image regions; calculating, for each point of interest, a region value for texture surrounding the point of interest, wherein calculating the region value for a particular point of interest comprises: calculating at least one local binary pattern in a square-shaped neighborhood (BP) for the particular point of interest; calculating at least one BP for one or more points offset from the particular point of interest; and setting the region value for texture surrounding the particular point of interest to an average of region values calculated for the particular point of interest and a plurality of the offset points; and determining at least one quality metric for at least a portion of the image of the facial region based on the points of interest and the respective calculated region values.

Another aspect of the present invention provides a system comprising: at least one memory for storing computer-executable instructions; and at least one processing unit for executing the instructions stored on the at least one memory, wherein execution of the instructions programs the at least one processing unit to perform operations comprising: receiving an image of a facial region of a user, the facial region including an eye and an area surrounding the eye; defining an ocular image region including at least a portion of the eye in the image of the facial region; defining one or more periocular image regions each including at least a portion of the area surrounding the eye in the image of the facial region; identifying a plurality of points of interest in at least one of the ocular image region and the one or more periocular image regions; calculating, for each point of interest, a region value for texture surrounding the point of interest, wherein calculating the region value for a particular point of interest comprises: calculating at least one local binary pattern in a square-shaped neighborhood (BP) for the particular point of interest; calculating at least one BP for one or more points offset from the particular point of interest; and setting the region value for texture surrounding the particular point of interest to an average of region values calculated for the particular point of interest and a plurality of the offset points; and determining at least

one quality metric for at least a portion of the image of the facial region based on the points of interest and the respective calculated region values.

Another aspect of the present invention provides a computer-implemented method comprising: receiving an image of a facial region of a user, the facial region including an eye and an area surrounding the eye; defining an ocular image region including at least a portion of the eye in the image of the facial region; defining one or more periocular image regions each including at least a portion of the area surrounding the eye in the image of the facial region; identifying a plurality of points of interest in at least one of the ocular image region and the one or more periocular image regions; calculating, for each point of interest, a region value for texture surrounding the point of interest, wherein calculating the region value for a particular point of interest comprises: calculating at least one local binary pattern in a square-shaped neighborhood (BP) for the particular point of interest, wherein calculating at least one BP for the particular point of interest comprises calculating a plurality of BPs, each having a different neighborhood, for the particular point of interest; calculating at least one BP for one or more points offset from the particular point of interest, wherein calculating at least one BP for the offset points comprises calculating a plurality of BPs, each having a different neighborhood, for each offset point; wherein calculating the plurality of BPs for a particular point of interest or offset point comprises: reducing the plurality of BPs to a Noisy Binary Pattern (NBP); and creating a general binary pattern (genBP) from the NBP; and determining at least one quality metric for at least a portion of the image of the facial region based on the points of interest and the respective calculated region values.

Another aspect of the present invention provides a system comprising: at least one memory for storing computer-executable instructions; and at least one processing unit for executing the instructions stored on the at least one memory, wherein execution of the instructions programs the at least one processing unit to perform operations comprising: receiving an image of a facial region of a user, the facial region including an eye and an area surrounding the eye; defining an ocular image region including at least a portion of the eye in the image of the facial region; defining one or more periocular image regions each including at least a portion of the area surrounding the eye in the image of the facial region; identifying a plurality of points of interest in at least one of the ocular image region and the one or more periocular image regions; calculating, for each point of interest, a region value for texture surrounding the point of interest, wherein calculating the region value for a particular point of interest comprises: calculating at least one local binary pattern in a square-shaped

neighborhood (BP) for the particular point of interest, wherein calculating at least one BP for the particular point of interest comprises calculating a plurality of BPs, each having a different neighborhood, for the particular point of interest; calculating at least one BP for one or more points offset from the particular point of interest, wherein calculating at least one BP for the offset points comprises calculating a plurality of BPs, each having a different neighborhood, for each offset point; wherein calculating the plurality of BPs for a particular point of interest or offset point comprises: reducing the plurality of BPs to a Noisy Binary Pattern (NBP); and creating a general binary pattern (genBP) from the NBP; and determining at least one quality metric for at least a portion of the image of the facial region based on the points of interest and the respective calculated region values.

Another aspect of the present invention provides a computer-implemented method comprising: receiving an image of a facial region of a user, the facial region including an eye and an area surrounding the eye; defining an ocular image region including at least a portion of the eye in the image of the facial region; defining one or more periocular image regions each including at least a portion of the area surrounding the eye in the image of the facial region; identifying a plurality of points of interest in at least one of the ocular image region and the one or more periocular image regions; calculating, for each point of interest, a region value for texture surrounding the point of interest; and determining at least one quality metric for at least a portion of the image of the facial region based on the points of interest and the respective calculated region values, wherein determining the quality metric comprises: creating an ordered list of the points of interest based on respective region values of the points of interest; and calculating distances between consecutive points of interest in the ordered list, wherein the quality metric is calculated as:

$$\sum_{n=1}^p s_n * sw_n * dw_n$$

where p comprises the number of points of interest, s_n comprises the region value calculated for point of interest n , sw_n comprises a weighted index for point of interest n , and dw_n comprises a weight for the distance corresponding to point n in the ordered list.

Another aspect of the present invention provides a system comprising: at least one memory for storing computer-executable instructions; and at least one processing unit for executing the instructions stored on the at least one memory, wherein execution of the instructions programs the at least one processing unit to perform operations comprising:

receiving an image of a facial region of a user, the facial region including an eye and an area surrounding the eye; defining an ocular image region including at least a portion of the eye in the image of the facial region; defining one or more periocular image regions each including at least a portion of the area surrounding the eye in the image of the facial region; identifying a plurality of points of interest in at least one of the ocular image region and the one or more periocular image regions; calculating, for each point of interest, a region value for texture surrounding the point of interest; and determining at least one quality metric for at least a portion of the image of the facial region based on the points of interest and the respective calculated region values, wherein determining the quality metric comprises: creating an ordered list of the points of interest based on respective region values of the points of interest; and calculating distances between consecutive points of interest in the ordered list, wherein the quality metric is calculated as:

$$\sum_{n=1}^p s_n * sw_n * dw_n$$

where p comprises the number of points of interest, s_n comprises the region value calculated for point of interest n , sw_n comprises a weighted index for point of interest n , and dw_n comprises a weight for the distance corresponding to point n in the ordered list.

[0005] In one implementation, the plurality of periocular image regions comprises at least four periocular image regions. The at least four periocular image regions can comprise a periocular image region disposed below the ocular image region, a periocular image region disposed to the right of the ocular image region, a periocular image region disposed to the left of the ocular image region, and a periocular image region disposed above the ocular image region.

[0006] Defining the plurality of periocular image regions can comprise defining a lower periocular image region disposed below the ocular image region, the lower periocular image region having a width substantially equal to a width of the ocular image region width and a height in the range of 10% to 300% of a height of the ocular image region. Defining the plurality of periocular image regions can also comprise defining a right periocular image region disposed to the right of the ocular image region, the right periocular image region having a width in the range of 10% to 80% of a width of the ocular image region and a height of 120% to 550% of a height of the ocular image region. Defining the plurality of periocular image regions can further comprise defining a left periocular image region disposed to the

left of the ocular image region, the left periocular image region having a width in the range of 10% to 50% of a width of the ocular image region and a height of 120% to 550% of a height of the ocular image region. Defining the plurality of periocular image regions can also comprise defining an upper periocular image region disposed above the ocular image region, the upper periocular image region having a width substantially equal to a width of the ocular image region width and a height in the range of 10% to 150% of a height of the ocular image region

[0007] In another implementation, calculating the one or more biometric match scores comprises: calculating a first biometric match score based on the ocular image region and an ocular enrollment template; and in response to determining that the first biometric match score does not meet a first match threshold, calculating a second biometric match score based

CLAIMS

1. A computer-implemented method comprising:

receiving an image of a facial region of a user, the facial region including an eye and an area surrounding the eye;

defining an ocular image region including at least a portion of the eye in the image of the facial region;

defining one or more periocular image regions each including at least a portion of the area surrounding the eye in the image of the facial region;

ranking the periocular image regions based on respective quality metrics separately calculated for each of the periocular image regions;

identifying a plurality of points of interest in at least one of the ocular image region and the one or more periocular image regions;

calculating, for each point of interest, a region value for texture surrounding the point of interest; and

determining at least one quality metric for at least a portion of the image of the facial region based on the points of interest and the respective calculated region values.

2. The method of claim 1, wherein calculating the region value for a particular point of interest comprises:

calculating at least one local binary pattern in a square-shaped neighborhood (BP) for the particular point of interest; and

calculating at least one BP for one or more points offset from the particular point of interest.

3. The method of claim 2, wherein calculating the region value for the particular point of interest further comprises setting the region value to an average of region values calculated for the particular point of interest and a plurality of the offset points.

4. The method of claim 2, wherein calculating at least one BP for the particular point of interest comprises calculating a plurality of BPs, each having a different neighborhood, for the particular point of interest, and wherein calculating at least one BP for the offset points comprises calculating a plurality of BPs, each having a different neighborhood, for each offset point.

5. The method of claim 4, wherein calculating the plurality of BPs for a particular point of interest or offset point comprises:

reducing the plurality of BPs to a Noisy Binary Pattern (NBP); and

creating a general binary pattern (genBP) from the NBP.

6. The method of claim 5, wherein calculating the plurality of BPs for a particular point of interest or offset point further comprises:

creating a weighted pattern H from the genBP; and

calculating a region value for the particular point of interest or offset point as:

$$\frac{(L * \sum H)}{144}$$

where L comprises a maximum length of continuous zeros in the genBP.

7. The method of claim 2, wherein the offset points comprise a plurality of pixel locations uniformly shifted in different directions from the particular point of interest.

8. The method of claim 1, wherein determining the quality metric comprises:

creating an ordered list of the points of interest based on respective region values of the points of interest; and

calculating distances between consecutive points of interest in the ordered list.

9. The method of claim 8, wherein determining the quality metric further comprises calculating the quality metric as:

$$\sum_{n=1}^p s_n * sw_n * dw_n$$

where p comprises the number of points of interest, s_n comprises the region value calculated for point of interest n , sw_n comprises a weighted index for point of interest n , and dw_n comprises a weight for the distance corresponding to point n in the ordered list.

10. The method of claim 1, wherein the at least a portion of the image of the facial region comprises the ocular region or at least one of the periocular regions.

11. The method of claim 1, further comprising ranking the periocular image regions based on at least one of a respective discriminative power of each periocular image region.

12. The method of claim 11, further comprising using the periocular image regions in a progressive biometric matcher based at least in part on the respective quality metric and/or discriminative power rankings of the periocular image regions.

13. The method of claim 1, further comprising:

determining that a difference in calculated quality metrics between a first one of the ocular or periocular image regions and a second one of the ocular or periocular image regions exceeds a threshold; and

indicating a likely presence of a spoof based on the determined difference in calculated quality metrics.

14. A system comprising:

at least one memory for storing computer-executable instructions; and

at least one processing unit for executing the instructions stored on the at least one memory, wherein execution of the instructions programs the at least one processing unit to perform operations comprising:

receiving an image of a facial region of a user, the facial region including an

eye and an area surrounding the eye;

defining an ocular image region including at least a portion of the eye in the image of the facial region;

defining one or more periocular image regions each including at least a portion of the area surrounding the eye in the image of the facial region;

ranking the periocular image regions based on respective quality metrics separately calculated for each of the periocular image regions;

identifying a plurality of points of interest in at least one of the ocular image region and the one or more periocular image regions;

calculating, for each point of interest, a region value for texture surrounding the point of interest; and

determining at least one quality metric for at least a portion of the image of the facial region based on the points of interest and the respective calculated region values.

15. The system of claim 14, wherein calculating the region value for a particular point of interest comprises:

calculating at least one local binary pattern in a square-shaped neighborhood (BP) for the particular point of interest; and

calculating at least one BP for one or more points offset from the particular point of interest.

16. The system of claim 15, wherein calculating the region value for the particular point of interest further comprises setting the region value to an average of region values calculated for the particular point of interest and a plurality of the offset points.

17. The system of claim 15, wherein calculating at least one BP for the particular point of interest comprises calculating a plurality of BPs, each having a different neighborhood, for the particular point of interest, and wherein calculating at least one BP for the offset points

comprises calculating a plurality of BPs, each having a different neighborhood, for each offset point.

18. The system of claim 17, wherein calculating the plurality of BPs for a particular point of interest or offset point comprises:

reducing the plurality of BPs to a Noisy Binary Pattern (NBP); and
creating a general binary pattern (genBP) from the NBP.

19. The system of claim 18, wherein calculating the plurality of BPs for a particular point of interest or offset point further comprises:

creating a weighted pattern H from the genBP; and
calculating a region value for the particular point of interest or offset point as:

$$\frac{(L * \sum H)}{144}$$

where L comprises a maximum length of continuous zeros in the genBP.

20. The system of claim 15, wherein the offset points comprise a plurality of pixel locations uniformly shifted in different directions from the particular point of interest.

21. The system of claim 14, wherein determining the quality metric comprises:

creating an ordered list of the points of interest based on respective region values of the points of interest; and

calculating distances between consecutive points of interest in the ordered list.

22. The system of claim 21, wherein determining the quality metric further comprises calculating the quality metric as:

$$\sum_{n=1}^p s_n * sw_n * dw_n$$

where p comprises the number of points of interest, s_n comprises the region value calculated for point of interest n , sw_n comprises a weighted index for point of interest n , and dw_n comprises a weight for the distance corresponding to point n in the ordered list.

23. The system of claim 14, wherein the at least a portion of the image of the facial region comprises the ocular region or at least one of the periocular regions.

24. The system of claim 14, wherein the operations further comprise ranking the periocular image regions based on respective at least one of a respective discriminative power of each periocular image region.

25. The system of claim 24, wherein the operations further comprise using the periocular image regions in a progressive biometric matcher based at least in part on the respective quality metric and/or discriminative power rankings of the periocular image regions.

26. The system of claim 14, wherein the operations further comprise:

determining that a difference in calculated quality metrics between a first one of the ocular or periocular image regions and a second one of the ocular or periocular image regions exceeds a threshold; and

indicating a likely presence of a spoof based on the determined difference in calculated quality metrics.

27. A computer-implemented method comprising:

receiving an image of a facial region of a user, the facial region including an eye and an area surrounding the eye;

defining an ocular image region including at least a portion of the eye in the image of the facial region;

defining one or more periocular image regions each including at least a portion of the area surrounding the eye in the image of the facial region;

identifying a plurality of points of interest in at least one of the ocular image region and the one or more periocular image regions;

calculating, for each point of interest, a region value for texture surrounding the point of interest, wherein calculating the region value for a particular point of interest comprises:

calculating at least one local binary pattern in a square-shaped neighborhood (BP) for the particular point of interest;

calculating at least one BP for one or more points offset from the particular point of interest; and

setting the region value for texture surrounding the particular point of interest to an average of region values calculated for the particular point of interest and a plurality of the offset points; and

determining at least one quality metric for at least a portion of the image of the facial region based on the points of interest and the respective calculated region values.

28. The method of claim 27, wherein calculating at least one BP for the particular point of interest comprises calculating a plurality of BPs, each having a different neighborhood, for the particular point of interest, and wherein calculating at least one BP for the offset points comprises calculating a plurality of BPs, each having a different neighborhood, for each offset point.

29. The method of claim 28, wherein calculating the plurality of BPs for a particular point of interest or offset point comprises:

reducing the plurality of BPs to a Noisy Binary Pattern (NBP); and

creating a general binary pattern (genBP) from the NBP.

30. The method of claim 29, wherein calculating the plurality of BPs for a particular point of interest or offset point further comprises:

creating a weighted pattern H from the genBP; and

calculating a region value for the particular point of interest or offset point as:

$$\frac{(L * \sum H)}{144}$$

where L comprises a maximum length of continuous zeros in the genBP.

31. The method of claim 27, wherein the offset points comprise a plurality of pixel locations uniformly shifted in different directions from the particular point of interest.

32. A system comprising:

at least one memory for storing computer-executable instructions; and

at least one processing unit for executing the instructions stored on the at least one memory, wherein execution of the instructions programs the at least one processing unit to perform operations comprising:

receiving an image of a facial region of a user, the facial region including an eye and an area surrounding the eye;

defining an ocular image region including at least a portion of the eye in the image of the facial region;

defining one or more periocular image regions each including at least a portion of the area surrounding the eye in the image of the facial region;

identifying a plurality of points of interest in at least one of the ocular image region and the one or more periocular image regions;

calculating, for each point of interest, a region value for texture surrounding the point of interest, wherein calculating the region value for a particular point of interest comprises:

calculating at least one local binary pattern in a square-shaped neighborhood (BP) for the particular point of interest;

calculating at least one BP for one or more points offset from the particular point of interest; and

setting the region value for texture surrounding the particular point of interest to an average of region values calculated for the particular point of

interest and a plurality of the offset points; and

determining at least one quality metric for at least a portion of the image of the facial region based on the points of interest and the respective calculated region values.

33. The system of claim 32, wherein calculating at least one BP for the particular point of interest comprises calculating a plurality of BPs, each having a different neighborhood, for the particular point of interest, and wherein calculating at least one BP for the offset points comprises calculating a plurality of BPs, each having a different neighborhood, for each offset point.

34. The system of claim 33, wherein calculating the plurality of BPs for a particular point of interest or offset point comprises:

reducing the plurality of BPs to a Noisy Binary Pattern (NBP); and

creating a general binary pattern (genBP) from the NBP.

35. The system of claim 34, wherein calculating the plurality of BPs for a particular point of interest or offset point further comprises:

creating a weighted pattern H from the genBP; and

calculating a region value for the particular point of interest or offset point as:

$$\frac{(L * \sum H)}{144}$$

where L comprises a maximum length of continuous zeros in the genBP.

36. The system of claim 32, wherein the offset points comprise a plurality of pixel locations uniformly shifted in different directions from the particular point of interest.

37. A computer-implemented method comprising:

receiving an image of a facial region of a user, the facial region including an eye and

an area surrounding the eye;

defining an ocular image region including at least a portion of the eye in the image of the facial region;

defining one or more periocular image regions each including at least a portion of the area surrounding the eye in the image of the facial region;

identifying a plurality of points of interest in at least one of the ocular image region and the one or more periocular image regions;

calculating, for each point of interest, a region value for texture surrounding the point of interest, wherein calculating the region value for a particular point of interest comprises:

calculating at least one local binary pattern in a square-shaped neighborhood (BP) for the particular point of interest, wherein calculating at least one BP for the particular point of interest comprises calculating a plurality of BPs, each having a different neighborhood, for the particular point of interest;

calculating at least one BP for one or more points offset from the particular point of interest, wherein calculating at least one BP for the offset points comprises calculating a plurality of BPs, each having a different neighborhood, for each offset point;

wherein calculating the plurality of BPs for a particular point of interest or offset point comprises:

reducing the plurality of BPs to a Noisy Binary Pattern (NBP); and

creating a general binary pattern (genBP) from the NBP; and

determining at least one quality metric for at least a portion of the image of the facial region based on the points of interest and the respective calculated region values.

38. The method of claim 37, wherein calculating the region value for the particular point of interest further comprises setting the region value to an average of region values calculated for the particular point of interest and a plurality of the offset points.

39. The method of claim 37, wherein calculating the plurality of BPs for a particular point

of interest or offset point further comprises:

creating a weighted pattern H from the genBP; and

calculating a region value for the particular point of interest or offset point as:

$$\frac{(L * \sum H)}{144}$$

where L comprises a maximum length of continuous zeros in the genBP.

40. A system comprising:

at least one memory for storing computer-executable instructions; and

at least one processing unit for executing the instructions stored on the at least one memory, wherein execution of the instructions programs the at least one processing unit to perform operations comprising:

receiving an image of a facial region of a user, the facial region including an eye and an area surrounding the eye;

defining an ocular image region including at least a portion of the eye in the image of the facial region;

defining one or more periocular image regions each including at least a portion of the area surrounding the eye in the image of the facial region;

identifying a plurality of points of interest in at least one of the ocular image region and the one or more periocular image regions;

calculating, for each point of interest, a region value for texture surrounding the point of interest, wherein calculating the region value for a particular point of interest comprises:

calculating at least one local binary pattern in a square-shaped neighborhood (BP) for the particular point of interest, wherein calculating at least one BP for the particular point of interest comprises calculating a plurality of BPs, each having a different neighborhood, for the particular point of interest;

calculating at least one BP for one or more points offset from the particular point of interest, wherein calculating at least one BP for the offset

points comprises calculating a plurality of BPs, each having a different neighborhood, for each offset point;

wherein calculating the plurality of BPs for a particular point of interest or offset point comprises:

reducing the plurality of BPs to a Noisy Binary Pattern (NBP);

and

creating a general binary pattern (genBP) from the NBP; and

determining at least one quality metric for at least a portion of the image of the facial region based on the points of interest and the respective calculated region values.

41. The system of claim 40, wherein calculating the region value for the particular point of interest further comprises setting the region value to an average of region values calculated for the particular point of interest and a plurality of the offset points.

42. The system of claim 40, wherein calculating the plurality of BPs for a particular point of interest or offset point further comprises:

creating a weighted pattern H from the genBP; and

calculating a region value for the particular point of interest or offset point as:

$$\frac{(L * \sum H)}{144}$$

where L comprises a maximum length of continuous zeros in the genBP.

43. A computer-implemented method comprising:

receiving an image of a facial region of a user, the facial region including an eye and an area surrounding the eye;

defining an ocular image region including at least a portion of the eye in the image of the facial region;

defining one or more periocular image regions each including at least a portion of the

area surrounding the eye in the image of the facial region;

identifying a plurality of points of interest in at least one of the ocular image region and the one or more periocular image regions;

calculating, for each point of interest, a region value for texture surrounding the point of interest; and

determining at least one quality metric for at least a portion of the image of the facial region based on the points of interest and the respective calculated region values, wherein determining the quality metric comprises:

creating an ordered list of the points of interest based on respective region values of the points of interest; and

calculating distances between consecutive points of interest in the ordered list, wherein the quality metric is calculated as:

$$\sum_{n=1}^p s_n * sw_n * dw_n$$

where p comprises the number of points of interest, s_n comprises the region value calculated for point of interest n , sw_n comprises a weighted index for point of interest n , and dw_n comprises a weight for the distance corresponding to point n in the ordered list.

44. The method of claim 43, wherein the at least a portion of the image of the facial region comprises the ocular region or at least one of the periocular regions.

45. The method of claim 43, further comprising:

determining that a difference in calculated quality metrics between a first one of the ocular or periocular image regions and a second one of the ocular or periocular image regions exceeds a threshold; and

indicating a likely presence of a spoof based on the determined difference in calculated quality metrics.

46. A system comprising:

at least one memory for storing computer-executable instructions; and

at least one processing unit for executing the instructions stored on the at least one memory, wherein execution of the instructions programs the at least one processing unit to perform operations comprising:

receiving an image of a facial region of a user, the facial region including an eye and an area surrounding the eye;

defining an ocular image region including at least a portion of the eye in the image of the facial region;

defining one or more periocular image regions each including at least a portion of the area surrounding the eye in the image of the facial region;

identifying a plurality of points of interest in at least one of the ocular image region and the one or more periocular image regions;

calculating, for each point of interest, a region value for texture surrounding the point of interest; and

determining at least one quality metric for at least a portion of the image of the facial region based on the points of interest and the respective calculated region values, wherein determining the quality metric comprises:

creating an ordered list of the points of interest based on respective region values of the points of interest; and

calculating distances between consecutive points of interest in the ordered list, wherein the quality metric is calculated as:

$$\sum_{n=1}^p s_n * sw_n * dw_n$$

where p comprises the number of points of interest, s_n comprises the region value calculated for point of interest n , sw_n comprises a weighted index for point of interest n , and dw_n comprises a weight for the distance corresponding to point n in the ordered list.

47. The system of claim 46, wherein the at least a portion of the image of the facial region comprises the ocular region or at least one of the periocular regions.

48. The system of claim 46, wherein the operations further comprise:

determining that a difference in calculated quality metrics between a first one of the ocular or periocular image regions and a second one of the ocular or periocular image regions exceeds a threshold; and

indicating a likely presence of a spoof based on the determined difference in calculated quality metrics.