Patent claims

1. Method for differentiating between background and foreground of a scenery in images recorded by an electronic camera,
the background showing an arbitrary image coded with a coding such that the image is visible for a direct observer of the background,
and the background being differentiated from the non-coded foreground in a signal produced by an image sensor, recording the images, of the camera by means of the coding.

2. Method according to the preceding claim, wherein the coding comprises the background showing the image as a periodic sequence of components composing the image, at least one imaging parameter which influences the display of the image being respectively changed in the course of each period, and an exposure of the image sensor of the camera being effected synchronously with the display of a specific component.

3. Method according to the preceding claim, wherein a temporal averaging of the coded image over at least one period corresponds to the image.

4. Method according to one of the two preceding claims, wherein a period duration of a recording cycle of the image

sensor is less than or equal to a period duration of the periodic sequence of the display of the components.

5. Method according to one of the preceding claims,
the coding comprising the background displaying periodically alternating different components of the image, the components of respectively each period composing the complete image,
the display of the components being synchronised with an exposure of the camera such that the camera records only one of the components in at least one, preferably each period.

6. Method according to the preceding claim, wherein
the component recorded by the camera is chosen such that it allows a differentiation of the foreground from the background by means of keying, preferably by means of chroma-keying,
and in that the background is differentiated from the foreground in the images recorded by the image sensor by means of keying, preferably by means of chroma-keying.

7. Method according to the preceding claim, wherein the component of one period recorded by the image sensor displays increased a colour component essentially not occurring in the foreground and the other components display this colour component correspondingly reduced such that the components together compose the colours of the image.

8. Method according to one of the claims 2 to 7, wherein two components being shown alternating with a frequency which is twice as high as an exposure frequency of the camera.

9. Method according to one of the preceding claims, characterised in that the coding of the image comprises the background displaying periodically alternating patterns which complement each other within one period to form the complete image and in that the background is differentiated from the foreground in the signal of the image sensor by means of the periodically alternating pattern.

10. Method according to the preceding claim, wherein an exposure frequency of the image sensor and the display of the pattern is synchronised with each other and/or a Fourier transform is implemented in the signal of the image sensor and the background is differentiated from the foreground by means of the frequency of the alternating display of the patterns.

11. Method according to one of the two preceding claims, wherein the pattern exists in a mathematically distinguishable structure, preferably being periodic in a scanning direction of the image sensor, the pattern preferably being a chessboard pattern.

12. Method according to one of the claims 9 to 11,
each of the patterns of one period is a binary pattern which is completely light-permeable or self-illuminating in regions and being less light permeable or less permeable for light of one colour in regions or impermeable for the

corresponding light or illuminating more weakly or not at all in the corresponding colour.

13. Method according to claim 1, wherein the coding comprises the background displaying the image only with colours selected from one, preferably at least two, ranges of the visible spectrum at a spacing from each other, and light emanating from the background running through a colour filter, preferably an interference filter, before impinging on the image sensor, which colour filter filters out or tones down these ranges of the visible spectrum, and letting other ranges of the visible spectrum pass through without being toned down.

14. Method according to claim 1 or 13, characterised in that the coding comprises the image being represented in a grid of coloured dots on a backdrop, the coloured dots respectively together with the backdrop surrounding them composing the colour of the image, and
a colour filter being disposed in front of the image sensor, which colour filter tones down the colours of the coloured dots and preferably lets through the colours of the backdrop without being toned down, the background being differentiated from the foreground by means of keying, preferably chroma-keying, on the colour of the backdrop.

15. Method according to the preceding claim, wherein
the colours of the coloured dots and the colours of the backdrop form disjoint parts of the visible spectrum, preferably the light of the coloured dots running through at least one spectral filter, preferably interference filter,

which the light emitted from the backdrop does not run through, and in that the filter disposed in front of the image sensor being a spectral filter, preferably interference filter, which is complementary to the interference filter or filters in front of the coloured dots.

16. Method according to one of the two preceding claims, wherein the coloured dots are self-illuminating, preferably light diodes.

17. Method according to claim 1 or 13, wherein the coding comprises the background radiating only colours selected from at least one, preferably at least two, ranges of the visible spectrum at a spacing from each other in the spectrum, the light emanating from the scenery running through a colour filter before impinging on the image sensor, which colour filter tones down those ranges of the visible spectrum from which the colours of the image are selected, and letting through ranges of the visible spectrum situated between these ranges without being toned down, the background being differentiated from the foreground by keying onto the ranges of the spectrum toned down by the colour filter in front of the image sensor.

18. Method according to the preceding claim, wherein an interference filter is disposed in the scenery behind the foreground and in front of the image, which interference filter tones down those ranges of the visible spectrum which are not those ranges from which the colours of the background are selected and wherein the colour filter which the light runs through before impinging on the image sensor

is an interference filter which is complementary to the mentioned interference filter.

19. Method according to claim 1, wherein the coding comprises the background radiating, letting through or reflecting electromagnetic radiation of at least one non-visible spectral range and a conversion device being disposed in front of the image sensor, which converts the non-visible electromagnetic radiation into visible light which is detected by the image sensor.

20. Method according to claim 19, wherein the conversion device is planar and converts, at least on a part of its surface, the non-visible radiation which is radiated, let through or reflected by the background into visible light which is detected by the image sensor and
the background being differentiated from the foreground by keying on the converted light.

21. Method according to the preceding claim, wherein the filter has dots of fluorescent or phosphorescent material distributed over its surface, preferably disposed in a grid, which dots illuminate in specific wavelengths by being excited by the non-visible radiation, and also a device, preferably a lens, assigned to each of the dots in order to image the corresponding fluorescent or phosphorescent dots onto the image sensor.

22. Method according to claim 1, wherein the coding comprises the background radiating or reflecting polarised light only

of one specific polarisation direction or polarisation rotation,
the light emanating from the scenery running through a colour filter and a polarisation filter before impinging on the image sensor, which filter is orientated such that it filters out light of that polarisation which is radiated and reflected from the background and
differentiation of the background from the foreground being effected by means of keying on darker regions of the image recorded by the image sensor which have no colour tone of the colour filter, the light emanating from the scenery preferably firstly running through the colour filter and subsequently the polarisation filter.

23. Method according to claim 19, wherein the electromagnetic radiation emanating from the scenery runs through the conversion device before impinging on the image sensor, preferably after running through an imaging lens system of the camera, which conversion device converts the non-visible electromagnetic radiation into visible light and blends it into the scenery from the perspective of the camera at the location of the background.

24. Method according to the preceding claim, wherein
the conversion device has a beam splitter which deflects a part of the radiation and/or the non-visible electromagnetic radiation towards a converter which blends an image corresponding to the background into the beam path in front of the image sensor, preferably via a partially permeable mirror, by means of the radiated electromagnetic radiation.

25. Method according to one of the preceding claims, wherein the coding of the image comprises an oscillation over the image sequence and the oscillation being taken into account in the differentiation of the foreground from the background.

26. Method according to one of the preceding claims, wherein the foreground is reconstructed in the image signal after differentiation of the background and foreground.

27. Method according to one of the preceding claims, wherein the image is located in the image of the image sensor with the help of camera tracking and/or the camera tracking assists the differentiation of the background and foreground.

28. Method for replacing a background in an image of a scenery, the background is differentiated from a foreground by means of a method according to one of the preceding claims and the background being replaced by a different background.

29. Electronic display system having at least one display and also at least one camera, a method according to one of the preceding claims being able to be implemented with the electronic display system.

Patent claims

1. Method for differentiating between background and foreground of a scenery in images recorded by an electronic camera,
the background showing an arbitrary image coded with a coding such that the image is visible for a direct observer of the background,
and the background being differentiated from the non-coded foreground in a signal produced by an image sensor, recording the images of the camera by means of the coding

the coding comprising the background displaying periodically alternating different components of the image, and

the display of the components being synchronised with an exposure of the camera such that the camera records only one of the components in at least one period.

2. Method according to the preceding claim, wherein the coding comprises the background showing the image as a periodic sequence of components composing the image, at least one imaging parameter which influences the display of the image being respectively changed in the course of each period, and an exposure of the image sensor of the camera being effected synchronously with the display of a specific component.

3. Method according to the preceding claim, wherein a temporal averaging of the coded image over at least one period corresponds to the image.

4. Method according to one of the two preceding claims, wherein a period duration of a recording cycle of the image sensor is less than or equal to a period duration of the periodic sequence of the display of the components.

5. Method according to one of the preceding claims, the components of respectively each period composing the complete image.

6. Method according to one of the preceding claims, wherein the component recorded by the camera is chosen such that it allows a differentiation of the foreground from the background by means of keying, preferably by means of chroma-keying, and in that the background is differentiated from the foreground in the images recorded by the image sensor by means of keying, preferably by means of chroma-keying.

7. Method according to the preceding claim, wherein the component of one period recorded by the image sensor displays increased a colour component essentially not occurring in the foreground and the other components display this colour component correspondingly reduced such that the components together compose the colours of the image.

8. Method according to one of the preceeding claims, wherein two components being shown alternating with a frequency which is twice as high as an exposure frequency of the camera.

9. Method according to one of the preceding claims, characterised in that the coding of the image comprises the background displaying periodically alternating patterns which complement each other within one period to form the complete image and in that the background is differentiated from the foreground in the signal of the image sensor by means of the periodically alternating pattern.

10. Method according to the preceding claim, wherein an exposure frequency of the image sensor and the display of the pattern is synchronised with each other and/or a Fourier transform is implemented in the signal of the image sensor and the background is differentiated from the foreground by means of the frequency of the alternating display of the patterns.

11. Method according to one of the two preceding claims, wherein the pattern exists in a mathematically distinguishable structure, preferably being periodic in a scanning direction of the image sensor, the pattern preferably being a chessboard pattern.

12. Method according to one of the claims 9 to 11,
each of the patterns of one period is a binary pattern which is completely light-permeable or self-illuminating in regions and being less light permeable or less permeable for light of one colour in regions or impermeable for the corresponding light or illuminating more weakly or not at all in the corresponding colour.

13. Method according to one of the preceding claims, wherein the coding of the image comprises an oscillation over the image sequence and the oscillation being taken into account in the differentiation of the foreground from the background.

14. Method according to one of the preceding claims, wherein the foreground is reconstructed in the image signal after differentiation of the background and foreground.

15. Method according to one of the preceding claims, wherein the image is located in the image of the image sensor with the help of camera tracking and/or the camera tracking assists the differentiation of the background and foreground.

16. Method for replacing a background in an image of a scenery, the background is differentiated from a foreground by means of a method according to one of the preceding claims and the background being replaced by a different background.

17. Electronic display system having at least one display and also at least one camera, a method according to one of the preceding claims being able to be implemented with the electronic display system.