CLAIMS

What is claimed is:

1. A method for controlling sharpness of objects in images in an auto-focus image system, comprising:

providing a user interface to accept a user□s command to initiate a seek to a next nearer/farther sharp focus position and/or request a forward/backward direction to seek to a next sharp focus position.

2. The method of claim 1, wherein the user interface accepts a user command to request skipping (N-1)-th sharp focus positions to reach and lock onto the N-th sharp focus position and causes a focus lens of the auto-focus image system to perform according to the user command.

3. The method of claim 2, further comprising:

seeking to the N-th sharp focus position upon said user command.

4. A method for generating a focus signal that is a function of a plurality of edge widths each of one of a plurality of edges in an image, comprising:

discriminating against a plurality of sharp-enough edges found at a plurality of sharp-focus positions.

5. The method of claim 4, further comprising:

finding an exclusion range that discriminates against said plurality of sharp-enough edges; and

filtering the plurality of edge widths using the exclusion range.

6. The method of claim 5, further comprising:

using the focus signal having the plurality of edge widths filtered by said filtering step to control a search for a sharp-focus position that is not among the plurality of sharp-focus positions.

7. A method for generating a focus signal that is a function of a plurality of edge widths each of one of a plurality of edges in an image, comprising:

forming from a first image an exclusion range from only sharp-enough edges in a given region; and

discriminating in a second image against edges by filtering edge widths using the exclusion range.

8. A method for generating a focus signal that is a function of a plurality of edge widths each of one of a plurality of edges in an image, comprising:

selecting a first characteristic from a plurality of characteristics;

forming exclusion range(s) of the first characteristic to discriminate against a plurality of not sharp-enough edges in the image.

9. The method of claim 8, further comprising:

selecting a second characteristic different from the first characteristic, the second characteristic excluding more edges that are not sharp-enough edges and that are not excluded by the exclusion ranges of the first characteristic than a third characteristic that is not selected.

10. A method for generating a focus signal that is a function of a plurality of edge widths each of one of a plurality of edges in an image, comprising:

finding a first set of exclusion ranges for a first characteristic from a first image;

finding a second set of exclusion range for the first characteristic from a second image;

filtering the second image using the first set of exclusion ranges to find a first population of sharp-enough edges and a second population of sharp-enough and not sharp-enough edges;

filtering the second image using the second set of exclusion ranges to find a third population of sharp-enough edges and a fourth population of sharp-enough and not sharp-enough edges;

finding a first ratio between the first population and the second population;

finding a second ratio between the third population and the fourth population;

comparing the first ratio with the second ratio; and

rejecting the first characteristic if there is a significant change from the first ratio to the second ratio.

11. A method of automatic focus control for an image system employing a focus signal that is a function of a plurality of edge widths each of one of a plurality of edges in an image, comprising:

servoing the focus signal to a target level that is offset from a optimal signal level that indicates a sharpest focusing of the plurality of edges whose edge widths contribute towards the focus signal, the target level indicating a less focused state of the plurality of edges than the optimal signal level.

12. A method for generating a focus signal that is a function of a plurality of edge widths each associated with one of a plurality of edges in an image, comprising:

correcting an edge width of an edge for a slant of a boundary, the edge width being measured along a first prescribed direction, the correcting being from the first prescribed direction to a direction perpendicular to the boundary.

13. The method of claim 12, wherein a correction for the slant is calculated from a first maximal gradient and a second maximal gradient, the first maximal gradient being a peak gradient of the edge and is in the first prescribed direction, the second maximal gradient being a largest gradient of two

pixels from the edge and in a second prescribed direction that is perpendicular to the first prescribed direction.

14. The method of claim 12, wherein the edge width is corrected to a corrected edge width that is a projection of the edge width to the direction perpendicular to the boundary.

15. A method for generating a focus signal that is a function of a plurality of edge widths each of one of a plurality of edges in an image, comprising:

reducing or eliminating a contribution to the focus signal from an edge width of a narrower edge adjacent to a wider edge, a peak gradient of the narrower edge having being smaller than a predetermined fraction of a peak gradient of the wider edge.

16. The method of claim 15, wherein the fraction is 80% or less.

CLAIMS

1. An image pickup apparatus, comprising:

a focus lens;

a pixel array that receives light from the focus lens; and

a focus signal generator,

wherein the focus signal generator generates a focus signal from a plurality of widths, each width being from a different one of a plurality of edges in an image, the image having been captured by the pixel array,

wherein a width of an edge is corrected to a reduced width along a second direction, the width being along a first prescribed direction.

2. The image pickup apparatus of claim 1, wherein the reduced width is calculated from the width using a first maximal gradient and a second maximal gradient, the first maximal gradient being a peak gradient of the edge and in the first prescribed direction, the second maximal gradient being a largest gradient within a predefined distance from the peak gradient and in a second prescribed direction that is perpendicular to the first prescribed direction.

3. The image pickup apparatus of claim 2, wherein the predefined distance is two pixels.

4. The image pickup apparatus of claim 1, wherein the reduced width is a projection of the width from the first prescribed direction to the second direction.

5. The image pickup apparatus of claim 1, wherein a ratio of the reduced width to the width is a function of a pair of mutually perpendicular gradients.

6. A method for generating a signal to indicate sharpness of image from a plurality of widths each associated with a different one of a plurality of edges in an image, comprising:

correcting by a processor a width of an edge to a reduced width along a second direction, the width being along a first prescribed direction; and

generating the signal from at least the reduced width.

7. The method of claim 6, wherein the reduced width is calculated from a first maximal gradient and a second maximal gradient, the first maximal gradient being a peak gradient of the edge and in the first prescribed direction, the second maximal gradient being a largest gradient within a predefined distance from the peak gradient and in a second prescribed direction, the second prescribed direction being perpendicular to the first prescribed direction.

8. The method of claim 7, wherein the predefined distance is two pixels.

9. The method of claim 6, wherein the reduced width is a projection of the width from the first prescribed direction to the second direction.

10. The method of claim 6, further comprising:

moving a focus lens in response to the focus signal.

11. The method of claim 7, further comprising:

moving a focus lens in response to the focus signal.

12. The method of claim 8, further comprising:

moving a focus lens in response to the focus signal.

13. The method of claim 9, further comprising:

moving a focus lens in response to the focus signal.

14. The method of claim 6, wherein a ratio of the reduced width to the width is a function of a pair of mutually perpendicular gradients.