What Is Claimed Is:

1. An image processing apparatus that converts input image data to output image data having two or more types of quantization data and outputs the output image data, comprising:

a pixel group reference point determination unit that divides the input image data into predetermined pixel groups and determines a position of a reference point from grayscale values of respective pixels contained in the pixel groups;

a pixel group expansion processing unit that takes the grayscale values of the part that is less than a threshold value from unprocessed pixels in periphery of the pixel group into the pixel group, if total of the grayscale values of the respective pixels contained in the pixel group is less than the threshold value based on each of values of the quantization data; and

a quantization data supply unit that supplies the quantization data to a pixel on the basis of the position of the reference point determined by the pixel group reference point determination unit.

2. An image processing apparatus that converts input image data to output image data having two or more types of quantization data and outputs the output image data, comprising:

a pixel group reference point determination unit that divides the input image data into predetermined pixel groups and determines a position of a reference point from grayscale values of respective pixels contained in the pixel groups;

a pixel group expansion processing unit that takes grayscale values of the part that is less than a threshold value from unprocessed pixels in periphery of the pixel group into the pixel group, if total of the grayscale values of the respective pixels contained in the pixel group is less than the threshold value based on each of values of the quantization data;

a quantization data supply unit that supplies the quantization data to a pixel on the basis of the position of the reference point determined by the pixel group reference point determination unit; and

a pulse width modulation unit that generates a pulse width of the K stages (K is a positive integer) in accordance with the quantization data supplied by the quantization data supply unit.

3. The image processing apparatus according to claim 1 or 2, wherein the pixel group reference point determination unit calculates the product of the pixel positions of the respective pixels and the grayscale values of the respective pixels for all the pixels contained in the pixel group, and determines a value in which a total of the product is divided in the total value of the grayscale values of the respective pixels contained in the pixel group as the position of the reference point.

4. The image processing apparatus according to any of claims 1 to 3, wherein the pixel group expansion processing unit takes grayscale values of the unprocessed pixels which is closest

position of the reference point determined by the pixel group reference point determination unit into the pixel group.

5. The image processing apparatus according to any of claims 1 to 4, wherein the pixel group reference point determination unit re-determines a position of the reference point on the basis of the pixel position and grayscale values of taken-into unprocessed pixels each time the pixel group expansion processing unit takes the grayscale values of the unprocessed pixels in periphery of the pixel group.

6. The image processing apparatus according to any of claims 1 to 5, wherein the quantization data supply unit selects preferentially from the closest pixels to the position of the reference point, and supplies the quantization data to the selected pixels.

7. The image processing apparatus according to any of claims 1 to 6, wherein the quantization data supply unit supplies a remainder value to the closest pixel from the position of the reference point which is a pixel other than the pixels to which the quantization data is supplied, if the quantization data supply unit supplies the quantization data to the pixel closest to the position of the reference point, in cases where there is the remainder value by subtracting the supplied quantization data from the total value of the grayscale values of the respective pixels contained in the pixel group.

8. The image processing apparatus according to any of claims 1 to 7, wherein the pixel group expansion processing unit takes grayscale values of the part that is less than the threshold value from unprocessed pixels in periphery of the pixel group into the pixel group, if the grayscale value of the pixel to which the remainder value is supplied by the quantization data supply unit is less than the threshold value.

9. An image processing apparatus that converts input image data of a plurality of colors to output image data having two or more types of quantization data, comprising:

a pixel group reference point determination unit that divides the input image data into predetermined pixel groups and determines a position of a reference point from grayscale values of respective pixels contained in the pixel groups;

a pixel group expansion processing unit that takes grayscale values of the part that is less than a threshold value from unprocessed pixels in periphery of the pixel group into the pixel group, if total of the grayscale values of the respective pixels contained in the pixel group is less than the threshold value based on each of values of the quantization data; and

a quantization data supply unit that supplies the quantization data to a pixel on the basis of the position of the reference point determined by the pixel group reference point determination unit,

wherein the difference of angle forming arrangement

direction of the pixel group between any two colors among the plurality of colors is substantially 30°.

10. An image processing method that converts input image data to output image data having two or more types of quantization data and outputs the output image data, comprising:

a pixel group reference point determination step of dividing the input image data into predetermined pixel groups and determining a position of a reference point from grayscale values of respective pixels contained in the pixel groups;

a pixel group expansion processing step of taking grayscale values of the part that is less than a threshold value from unprocessed pixels in periphery of the pixel group into the pixel group, if total of the grayscale values of the respective pixels contained in the pixel group is less than the threshold value based on each of values of the quantization data; and

a quantization data supply step of supplying the quantization data to a pixel on the basis of the position of the reference point determined by the pixel group reference point determination step.

11. An image processing program that converts input image data to output image data having two or more types of quantization data and outputs the output image data, the program causing a computer to execute:

a pixel group reference point determination step of dividing the input image data into predetermined pixel groups

and determining a position of a reference point from the grayscale values of respective pixels contained in the pixel groups;

a pixel group expansion processing step of taking grayscale values of the part that is less than a threshold value from unprocessed pixels in periphery of the pixel group into the pixel group, if total of the grayscale values of the respective pixels contained in the pixel group is less than the threshold value based on each of values of the quantization data; and

a quantization data supply step of supplying the quantization data to a pixel on the basis of the position of the reference point determined by the pixel group reference point determination step.

12. A recording medium that can be read by a computer on which the image processing program of claim 11 is recorded.