Important applications of this algorithm are in the field of film and video post production: for removing wires used in special effects scenes and for restoring old films and photographs that have become scratched.

In view of the above description, it will be appreciated by those skilled in the art that many variations, modifications and changes can be made to the present invention without departing from the spirit or scope of the present invention as defined by the claims appended hereto. All such variations, modifications and changes are fully contemplated by the present invention.

We claim:

1. A method of removing noise from image data, comprising the steps of:

defining an area of noise on the image data;

generating a noise mask to distinguish pixels inside the defined area of noise on the image data from pixels outside the area of noise on the image data;

defining repair image data including the defined area of noise;

defining sample image data which is similar to the repair image data;

creating from the noise mask a soft noise mask having a soft edge;

performing a frequency transform to the sample image data and to generate frequency transformed data of the sample image data;

performing the frequency transform to the repair image data to generate frequency transformed data of the repair image data;

performing an inverse transform of the frequency transformed data of the sample image data and the frequency transformed data of the repair image data to generate new repair image data; and

generating new image data using the new repair image data, the repair image data and the soft noise mask.

2. The method of claim 1, further comprising the step of:

creating mask repair image data in accordance with data of the soft noise mask.

3. The method of claim 1, wherein

the step of performing a frequency transform to the sample image data calculates a fast fourier transform of the sample image data to generate fast fourier transform data of the sample image data;

the step of performing a frequency transform to the repair image data calculates a fast fourier transform of the repair image data to generate fast fourier transform data of the repair image data;

the step of performing an inverse transform calculates an inverse fast fourier transform using the fast fourier transform data of the sample image data and the fast fourier transform data of the repair image data.

4. The method of claim 3, wherein

the step of calculating a fast fourier transform of the sample image data generates at least magnitudes;

the step of calculating a fast fourier transform of the repair image data generates a phase and magnitudes; and

the step of calculating an inverse fast fourier transform generates the new repair image data using a phase of the fast fourier transform data of the repair image data and one of the magnitudes of the fast fourier transform data of the sample image data and the magnitudes of the fast fourier transform data of the repair image data.

5. The method of claim 4, further comprising the step of:

comparing the magnitudes of the fast fourier transform data of the sample image data with magnitudes and minimum magnitudes of the fast fourier transform data of the repair image data,

wherein the step of performing an inverse transform generates the new image data using a selected one of the minimum magnitudes and the phase of the fast fourier transform data of the repair image data.

6. The method of claim 5, wherein

a magnitude of a DC component is selected as a magnitude of the fast fourier transform data of the repair image data.

7. The method of claim 1, further comprising the step of:

conforming the repair image data to a predetermined value.

8. The method of claim 1, further comprising the steps of:

receiving the image data;

displaying the image data; and

storing the soft noise mask, the repair image data and the sample image data.

9. The method of claim 1, wherein

the noise mask is binary data such that it is a value of 1 wherever there is no noise and a value of 0 wherever there is noise.

10. The method of claim 1, wherein

the soft noise mask is soft edged data such that it is a value of 0 wherever there is noise, a value of between 0 and 1 near the edge of the noise and a value of 1 at at least a certain distance from the edge of the noise.

11. The method of claim 10, wherein

the value of the noise mask outside a noise area defined by $1-\exp(-k\times d\times d)$, where k is a positive constant, and k is set to a large value where the noise mask is to have a broad soft edge, and k is set to a small value where the noise mask is to have a narrow soft edge, and where d is a distance from the edge of the noise.

12. The method of claim 1, wherein

the steps of performing a frequency transform to the sample image data, performing the frequency transform to the repair image data, performing an inverse transform of the frequency transformed data and generating new image data are recursively performed to generate new image data.

13. A method of removing noise from image data, comprising the steps of:

defining an area of noise on the image data;

generating noise mask data to distinguish pixels inside the defined area of noise on the image data from pixels outside the area of noise on the image data;

defining sample image data which is similar to the repair image data;

filtering the sample image data to generate low pass filtered sample image data and high pass filtered sample image data;

performing a frequency transform to the high pass filtered sample image data to generate frequency transformed data of the high pass filtered sample image data;

filtering the repair image data to generate low pass filtered repair image data and high pass filtered repair image data;

performing the frequency transform to the high pass filtered repair image data to generate frequency transformed data of the high pass filtered repair image data;