CLAIMS:

1. A method comprising:

imaging a sequential portion of a web to provide digital information;

processing the digital information with at least one initial algorithm to identify regions on the web containing anomalies;

identifying positions of the anomalies on the web;

based on the positions on the web, identifying a set of the anomalies as repeated anomalies and the remaining anomalies as random anomalies;

analyzing the digital information for the repeated anomalies with a first defect detection algorithm to determine which of the repeated anomalies represent actual defects for a product;

analyzing the digital information for the random anomalies with a second defect detection algorithm to determine which of the random anomalies represent actual defects for the product; and

converting the web into the product based on the determined actual defects for the product.

2. The method of claim 1, wherein the first defect detection algorithm is configured to apply an increased sensitivity to the repeated anomalies than the second detection algorithm applies to the random anomalies.

3. The method of claim 1, further comprising:

extracting a portion of the digital information for each of the identified regions, and

analyzing the extracted portions of the digital information with the first defect detection algorithm and the second defect detection algorithm to determine the actual defects in the web.

4. The method of claim 3, further comprising storing or buffering the extracted portions of the digital information prior to analyzing.

5. The method of claim 4, wherein the stored or buffered portions are analyzed after the imaging has been performed on the entire web.

6. The method of claim 1, wherein the initial algorithm comprises thresholding the digital information and forming a blob list.

7. The method of claim 1, wherein the first defect detection algorithm and the second defect detection algorithm each include one or more of neighborhood averaging, neighborhood ranking, contrast expansion, various monadic and dyadic image manipulations, digital filtering, texture analysis, fractal analysis, frequency processing, convolutions, morphological processing, thresholding, connected component analyses, blob processing or blob classifications.

8. The method of claim 1, wherein the first defect detection algorithm and the second defect detection algorithm each includes a plurality of image processing operations, wherein the plurality of steps for each algorithm include at least comparing each anomaly against a combination threshold-pixel size criterion.

9. The method of claim 8, wherein the combination threshold-pixel size criterion for the first defect detection algorithm defines a pixel size that is smaller than a pixel size defined by the threshold-pixel criterion for the second defect detection algorithm.

10. The method of claim 8, wherein the combination threshold-pixel size criterion for the first defect detection algorithm defines a pixel size that is larger than a pixel size defined by the threshold-pixel criterion for the second defect detection algorithm.

11. The method of claim 8, wherein an anomaly is identified as an actual defect if any one of the threshold-pixel size criteria is satisfied.

12. The method of claim 1, further comprising:

receiving roll synchronization signals from a plurality of sensors of a web manufacturing system, wherein each of the sensors corresponds to a different roller of the web manufacturing system, and wherein each of the roll synchronization signals indicates that the corresponding roller has completed a full rotation during manufacturing of the web;

13. A system comprising:

an encoder on at least one of the rollers that outputs a position signal indicative of a down-web distance of the web;

an imaging device that images a sequential portion of a web to provide digital information;

an analysis computer that processes the digital information with an initial algorithm to identify regions on the web containing anomalies, wherein the analysis computer processes the anomaly data to determine the positions of the anomalies on the web based on the position signal and identifies a set of the anomalies as repeated anomalies; and

a conversion control system that processes the digital information for the repeated anomalies with a first defect detection algorithm to determine which of the repeated anomalies represent actual defects for a product and analyzes the digital information for the random anomalies with a second defect detection algorithm to determine which of the random anomalies represent actual defects for the product.

14. The system of claim 13, further comprising:

a plurality of rollers in contact with the web during manufacturing, wherein two or more of the rollers each include a synchronization mark to indicate when the corresponding roller has completed a full rotation;

a plurality of synchronization mark readers that read the synchronization marks of the plurality of rollers and output roll synchronization signals, wherein each of the roll synchronization signals indicates that the corresponding roller has completed a full rotation during manufacturing of the web; and

a synchronization unit that receives the position signal from the encoder and the plurality of roll synchronization signals from the synchronization mark readers, wherein the synchronization unit converts the occurrence of each of the roll synchronization signals into down-web positions within a coordinate system associated with web process line,

wherein the analysis computer outputs an indication of which of the rollers caused the repeated anomalies by correlating the positions of the repeated anomalies with the down-web positions of the roll synchronization signals.

15. The system of claim 13, wherein the first defect detection algorithm is configured to apply an increased sensitivity to the repeated anomalies than the second detection algorithm applies to the random anomalies.

16. The system of claim 13, wherein the analysis computer extracts a portion of the digital information for each of the identified regions, and analyzes the extracted portions of the digital information with the first defect detection algorithm and the second defect detection algorithm to determine the actual defects in the web.

17. The system of claim 13, further comprising storing or buffering the extracted portions of the digital information prior to analyzing.

18. The system of claim 13, wherein the stored or buffered portions are analyzed after the imaging has been performed on the entire web.

19. The system of claim 13, wherein the initial algorithm comprises thresholding the digital information and forming a blob list.

20. The system of claim 13, wherein the first defect detection algorithm and the second defect detection algorithm each include one or more of neighborhood averaging, neighborhood ranking, contrast expansion, various monadic and dyadic image manipulations, digital filtering, texture analysis, fractal analysis, frequency processing, convolutions, morphological processing, thresholding, connected component analyses, blob processing or blob classifications.

21. The system of claim 13, wherein the first defect detection algorithm and the second defect detection algorithm each includes a plurality of image processing operations, wherein the plurality of steps for each algorithm include at least comparing each anomaly against a combination threshold-pixel size criterion.

22. The system of claim 21, wherein the combination threshold-pixel size criterion for the first defect detection algorithm defines a pixel size that is smaller than a pixel size defined by the threshold-pixel criterion for the second defect detection algorithm.

23. The system of claim 13, wherein the combination threshold-pixel size criterion for the first defect detection algorithm defines a pixel size that is larger than a pixel size defined by the threshold-pixel criterion for the second defect detection algorithm.

24. The system of claim 13, wherein an anomaly is identified as an actual defect if any one of the threshold-pixel size criteria is satisfied.

25. A computer-readable medium comprising instructions for causing a programmable processor to:

receive digital data from a web inspection system that identifies positions of anomalies on the web;

processing the digital information with at least one initial algorithm to identify regions on the web containing the anomalies;

based on the positions on the web, identify a set of the anomalies as repeated anomalies and the remaining anomalies as random anomalies;

analyze the digital information for the repeated anomalies with a first defect detection algorithm to determine which of the repeated anomalies represent actual defects for a product;

analyze the digital information for the random anomalies with a second defect detection algorithm to determine which of the random anomalies represent actual defects for the product; and

output a defect map to control conversion of the web to products, where the defect map specifies the positions of the actual defects.

CLAIMS:

1. A method comprising:

imaging a sequential portion of a web to provide digital information;

processing the digital information with at least one initial algorithm to identify regions on the web containing anomalies;

identifying positions of the anomalies on the web;

identifying, based on the positions of the anomalies on the web, a set of the anomalies as repeated anomalies and the remaining anomalies as random anomalies;

analyzing, by at least one processor, the digital information for the repeated anomalies with a first defect detection algorithm to determine, based on a first set of characteristics, which of the repeated anomalies represent actual defects for a product;

analyzing, by the at least one processor, the digital information for the random anomalies with a second, different defect detection algorithm to determine, based on a second set of characteristics, which of the random anomalies represent actual defects for the product, wherein at least one characteristic is included in both the first set of characteristics and the second set of characteristics, wherein the first defect detection algorithm is configured to apply a first threshold to the at least one characteristic to determine which of the repeated anomalies represent actual defects and the second detection algorithm is configured to apply a second threshold to the at least one characteristic to determine which of the random anomalies represent actual defects, and wherein the first threshold is lower than the second threshold; and

converting the web into at least two sheets based on the determined actual defects for the product.

2. The method of claim 1, wherein the first defect detection algorithm is configured to apply the first threshold to the at least one characteristic to determine which of the repeated anomalies represent actual defects by applying an increased sensitivity to the at least one characteristic to determine which of the repeated anomalies represent actual defects, and wherein the second, different detection algorithm is configured to apply the second threshold to the at least one characteristic to determine which of the random anomalies represent actual defects by applying a

decreased sensitivity to the at least one characteristic to determine which of the random anomalies represent actual defects.

3. The method of claim 1, further comprising:

extracting a portion of the digital information for each of the identified regions,

wherein analyzing, by the at least one processor, the digital information for the repeated anomalies with the first defect detection algorithm to determine, based on the first set of characteristics, which of the repeated anomalies represent actual defects for the product and analyzing, by the at least one processor, the digital information for the random anomalies with the second, different defect detection algorithm to determine, based on the second set of characteristics, which of the random anomalies represent actual defects for the product comprises analyzing the extracted portions of the digital information with the first defect detection algorithm and the second, different defect detection algorithm to determine the actual defects in the web.

4. The method of claim 3, further comprising storing or buffering the extracted portions of the digital information prior to analyzing.

5. The method of claim 4, wherein the stored or buffered portions are analyzed after the imaging has been performed on the entire web.

6. The method of claim 1, wherein processing the digital information with the at least one initial algorithm comprises thresholding the digital information and forming a blob list.

7. The method of claim 1, wherein the first defect detection algorithm and the second, different defect detection algorithm each include one or more of neighborhood averaging, neighborhood ranking, contrast expansion, various monadic and dyadic image manipulations, digital filtering, texture analysis, fractal analysis, frequency processing, convolutions, morphological processing, thresholding, connected component analyses, blob processing or blob classifications.

8. The method of claim 1, wherein the first defect detection algorithm and the second, different defect detection algorithm each includes a plurality of image processing steps, wherein the plurality of image processing steps for each algorithm include at least comparing each anomaly against a combination threshold-pixel size criterion.

9. The method of claim 8, wherein the combination threshold-pixel size criterion for the first defect detection algorithm defines a pixel size that is smaller than a pixel size defined by the combination threshold-pixel size criterion for the second, different defect detection algorithm.

10. The method of claim 8, wherein the combination threshold-pixel size criterion for the first defect detection algorithm defines a pixel size that is larger than a pixel size defined by the combination threshold-pixel size criterion for the second, different defect detection algorithm.

11. The method of claim 8, wherein an anomaly is identified as an actual defect if any one of the combination threshold-pixel size criteria is satisfied.

12. The method of claim 1, further comprising:

receiving roll synchronization signals from a plurality of sensors of a web manufacturing system, wherein each of the sensors corresponds to a different roller of the web manufacturing system, and wherein each of the roll synchronization signals indicates that the corresponding roller has completed a full rotation during manufacturing of the web.

13. A system comprising:

an encoder on at least one roller that outputs a position signal indicative of a down-web distance of a web;

an imaging device that images a sequential portion of the web to provide digital information;

an analysis computer that processes the digital information with at least one initial algorithm to identify regions on the web containing anomalies, wherein the analysis computer processes the anomaly data to determine the positions of the anomalies on the web based on the

position signal and identifies a set of the anomalies as repeated anomalies and the remaining anomalies as random anomalies; and

a conversion control system that:

analyzes the digital information for the repeated anomalies with a first defect detection algorithm to determine, based on a first set of characteristics, which of the repeated anomalies represent actual defects for a product and analyzes the digital information for the random anomalies with a second, different defect detection algorithm to determine, based on a second set of characteristics, which of the random anomalies represent actual defects for the product, wherein at least one characteristic is included in both the first set of characteristics and the second set of characteristics, wherein the first defect detection algorithm is configured to apply a first threshold to the at least one characteristic to determine which of the repeated anomalies represent actual defects and the second detection algorithm is configured to apply a second threshold to the at least one characteristic to determine which of the random anomalies represent actual defects, and wherein the first threshold is lower than the second threshold, and

converts the web into the product based on the determined actual defects for the product.

14. The system of claim 13, wherein the roller comprises a plurality of rollers in contact with the web during manufacturing, wherein two or more rollers of the plurality of rollers each include a synchronization mark to indicate when the corresponding roller has completed a full rotation, further comprising:

a plurality of synchronization mark readers that read the synchronization marks of the plurality of rollers and output roll synchronization signals, wherein each of the roll synchronization signals indicates that the corresponding roller has completed a full rotation during manufacturing of the web; and

a synchronization unit that receives the position signal from the encoder and the plurality of roll synchronization signals from the plurality of synchronization mark readers, wherein the synchronization unit converts the occurrence of each of the roll synchronization signals into down-web positions within a coordinate system associated with a web process line,

wherein the analysis computer outputs an indication of which of the rollers caused the repeated anomalies by correlating the positions of the repeated anomalies with the down-web positions of the roll synchronization signals.

15. The system of claim 13, wherein the first defect detection algorithm is configured to apply the first threshold to the at least one characteristic to determine which of the repeated anomalies represent actual defects by applying an increased sensitivity to the at least one characteristic to determine which of the repeated anomalies represent actual defects, and the second, different defect detection algorithm is configured to apply the second threshold to the at least one characteristic to determine which of the random anomalies represent actual defects by applying a decreased sensitivity to the at least one characteristic to determine which of the random anomalies represent actual defects.

16. The system of claim 13, wherein the analysis computer extracts a portion of the digital information for each of the identified regions, and the conversion control system analyzes the extracted portions of the digital information with the first defect detection algorithm and the second, different defect detection algorithm to determine the actual defects in the web.

17. The system of claim 13, wherein the analysis computer further stores or buffers the extracted portions of the digital information prior to analyzing the extracted portions of the digital information.

18. The system of claim 17, wherein the analysis computer analyzes the stored or buffered portions after the imaging device has imaged the entire web.

19. The system of claim 13, wherein the analysis computer processes the digital information with the initial algorithm by at least thresholding the digital information and forming a blob list.

20. The system of claim 13, wherein the first defect detection algorithm and the second, different defect detection algorithm each include one or more of neighborhood averaging, neighborhood ranking, contrast expansion, various monadic and dyadic image manipulations, digital filtering, texture analysis, fractal analysis, frequency processing, convolutions, morphological processing, thresholding, connected component analyses, blob processing or blob classifications.

21. The system of claim 13, wherein the first defect detection algorithm and the second, different defect detection algorithm each includes a plurality of image processing steps, wherein the plurality of steps for each algorithm include at least comparing each anomaly against a combination threshold-pixel size criterion.

22. The system of claim 21, wherein the combination threshold-pixel size criterion for the first defect detection algorithm defines a pixel size that is smaller than a pixel size defined by the combination threshold-pixel size criterion for the second, different defect detection algorithm.

23. The system of claim 21, wherein the combination threshold-pixel size criterion for the first defect detection algorithm defines a pixel size that is larger than a pixel size defined by the combination threshold-pixel size criterion for the second, different defect detection algorithm.

24. The system of claim 21, wherein an anomaly is identified as an actual defect if any one of the combination threshold-pixel size criteria is satisfied.

25. A computer-readable storage medium comprising instructions for causing a programmable processor to:

receive digital data from a web inspection system that identifies positions of anomalies on the web;

process the digital information with at least one initial algorithm to identify regions on the web containing the anomalies;

based on the positions of the anomalies on the web, identify a set of the anomalies as repeated anomalies and the remaining anomalies as random anomalies;

analyze the digital information for the repeated anomalies with a first defect detection algorithm to determine, based on a first set of characteristics, which of the repeated anomalies represent actual defects for a product;

analyze the digital information for the random anomalies with a second, different defect detection algorithm to determine, based on a second set of characteristics, which of the random anomalies represent actual defects for the product, wherein at least one characteristic is included in both the first set of characteristics and the second set of characteristics, wherein the first defect

detection algorithm is configured to apply a first threshold to the at least one characteristic to determine which of the repeated anomalies represent actual defects and the second detection algorithm is configured to apply a second threshold to the at least one characteristic to determine which of the random anomalies represent actual defects, wherein the first threshold is lower than the second threshold; and

output a defect map to control conversion of the web to products, where the defect map specifies the positions of the actual defects.

26. The method of claim 1, wherein the first threshold and the second threshold are determined based on a recipe for the product.

27. The system of claim 13, wherein the first threshold and the second threshold are determined based on a recipe for the product.

28. The computer-readable storage medium of claim 25, wherein the first threshold and the second threshold are determined based on a recipe for the product.