CLAIMS

What is claimed is:

1. A system for monitoring potential failure in a machine or a component thereof, the system comprising:

~~at least one optical sensor configured to be fixed on or in vicinity of the machine or the component thereof;~~

at least one processor in communication with at least one optical sensor ~~configured to be~~ fixed on or in vicinity of the machine or the component thereof;

~~the sensor~~, the processor being executable to:

receive signals from the at least one optical sensor;

obtain data associated with characteristics of at least one mode of failure of the machine or the component thereof;

~~—~~analyze dynamic movement of the machine or the component thereof by:

identifying at least one change in the received signals; and

for an identified change in the received signals, ~~apply the at least one identified change to an algorithm configured to~~ analyzinge the identified change in the received signals and ~~to~~ classifying whether the identified change in the received signals is associated with a mode of failure of the machine or the component thereof~~, thereby labeling the identified change as a fault~~, based, at least in part, on the obtained data; and

~~for an identified change is classified as being associated with a mode of failure,~~ output~~ting~~ a signal indicative of the classification of the identified change ~~associated with the mode of failure~~.

2. The system according to claim 1, wherein for an identified fault, generate at least one model of a trend in the identified ~~fault~~change associated with a mode of failure.

3. The system according to any one of claims ~~1-2~~2, wherein the trend comprises a rate of change in the ~~fault~~received signals.

4. The system according to ~~any one of claims 1-3~~claim 2 or claim 3, wherein generating the at least one model of trend in the identified fault comprises calculating a correlation of the rate of change of the fault with one or more environmental parameters.

5. The system according to any one of claims 1-4, further comprising alerting a user of a predicted failure based, at least in part, on the generated model.

6. The system according to claim 5, wherein alerting the user of a predicted failure comprises any one or more of a time (or range of times) of a predicted failure, a usage time of the machine and characteristics of the mode of failure, or any combination thereof.

~~7. The system according to any one of claims 1-6, wherein identifying at least one change in the signals comprises identifying a change in the rate of change in the signals.~~

~~8.~~7.The system according to any one of claims 4-~~7~~6, wherein the one or more environmental parameters comprise at least one of temperature, season or time of the year, pressure, time of day, hours of operation of the machine or the component thereof, duration of operation of the machine or the component thereof, an identified user of the machine, GPS location, mode of operation of the machine or the component thereof, or any combination thereof.

~~9.~~8.The system according to any one of claims 2-7, further comprising outputting a prediction of when the identified fault is likely to lead to failure in the machine or the component thereof, based, at least in part, on the generated model.

~~10.~~9. The system according to claim 8, wherein predicting when a failure is likely to occur in the machine or the component thereof is based, at least in part, on known future environmental parameters.

~~11.~~10. The system according to any one of claims 1-9, wherein the mode of failure comprises at least one of a change in dimension, a change in position, a change in color, a change in texture, change in size, a change in appearance, a fracture, a structural damage, a crack, crack size, critical crack size, crack

location, crack propagation, a specified pressure applied to the machine or the component thereof, a change in the movement of one component in relation to another component, an amount of leakage, a rate of leakage, change in rate of leakage, amount of accumulated liquid, a change in the amount of accumulated liquid size of formed bubbles, drops, puddles, jets, or any combination thereof.

12. ~~The system according to any one of claims 1-10, further comprising, if the identified change is not classified as being associated with a mode of failure, storing and/or using data associated with the identified change for further investigation, wherein the further investigation comprises at least one of adding a mode of failure, updating the algorithm configured to identify the change, and training the algorithm to ignore the identified change in the future, thereby improving the algorithm configured to identify the change.~~

13. ~~The system according to any one of claims 1-12, wherein obtaining data associated with characteristics of at least one mode of failure of the machine or the component thereof comprises data associated with a location of the mode of failure on the machine or the component thereof and/or a specific type of mode of failure.~~

14. ~~The system according to any one of claims 1-13, wherein obtaining data associated with characteristics of at least one mode of failure of the machine or the component thereof comprises receiving inputted data from a user.~~

15. ~~The system according to any one of claims 1-14, further comprising analyzing the received signal and wherein obtaining data associated with characteristics of at least one mode of failure of the machine or the component thereof comprises automatically retrieving the data from a database, based, at least in part, on the received signals from at least one optical sensor.~~

16. ~~The system according to any one of claims 1-15, wherein obtaining data associated with characteristics of at least one mode of failure of the machine or the component thereof comprises identifying a previously unknown failure mode by applying the received signals to a machine learning algorithm configured to determine a mode of failure of the machine or the component thereof.~~

~~17. The system according to any one of claims 1-16, wherein identifying the at least one change in the signals comprises analyzing raw data of the received signals.~~

~~18. The system according to any one of claims 1-17, wherein the at least one signal comprises at least one image, a portion of an image, a set of images, or a video.~~

~~19.~~11. The system according to any one of claims 1-~~18~~10, ~~wherein identifying the at least one change in the signals comprises analyzing dynamic movement of the machine or the component thereof,~~ wherein the dynamic movement comprising any one or more of linear movement, rotational movement, periodic (repetitive) movement, damage, defect, crack size/length, crack growth rate, crack propagation, fracture, structural damage, defect diameter, cut, warping, inflation, deformation, abrasion, wear, corrosion, oxidation, sparks, smoke, fluid flow rate, drop size, fluid volume, rate of accumulation of liquid, change in texture, change in color/shade, size of formed bubbles, drops, puddle forming, puddle propagation, a change in dimension, a change in position, a change in color, a change in texture, change in size, a change in appearance, or any combination thereof.

~~20.~~12. The system according to any one of claims 1-~~19~~11, further comprising identifying at least one segment within the received signals, to be monitored, and wherein the at least one change in the signals is a change within the at least one segment.

~~21.~~13. The system according to any one of claims 1-~~20~~12, further comprising monitoring the at least one segment and detecting a change in the shape of the at least one segment, size of the at least one segment, rate of occurrence of the at least one segment in the received signals, or any combination thereof.

~~22.~~14. The system according to ~~any one of claims 1-21~~claim 12 or claim 13, wherein the at least one segment comprises the boundaries of a surface defect.

~~23.~~15. The system according to any one of claims ~~1-22~~12-14, wherein the at least one segment comprises the boundaries of at least one of a perimeter of a puddle, a perimeter of a droplet, a perimeter of a saturated area (or material), or any combination thereof.

~~24.~~16. The system according to any one of claims ~~1-23~~12-15, wherein the at least one segment comprises the boundaries of a spark.

~~25. The system according to any one of claims 1-24, wherein the at least one segment comprises the boundaries of a specific element of the machine or the component thereof, and further comprising identifying a geometrical shape of the at least one segment as the specific element of the machine or the component thereof.~~

~~26. The system according to claim 25, wherein the specific element comprises any one or more of a screw, a connector, a bolt, one or more vehicles components, one or more fuel tanks, oil tanks, motors, gear box, turbine components, cables, belts, wires, fasteners, cylinders, blades, nuts, one or more flexible, semi-rigid, or rigid pipes/tubes, and any combination thereof.~~

~~27. The system according to any one of claims 25-26, wherein identifying the geometrical shape comprises analyzing any one or more of the total intensity, variance intensity, spackle detection, line segment detection, line segment registration, edge segment curvature estimation, homography estimation, specific object identification, object detection, semantic segmentation, background model, change detection, detection over optical flow, or reflection detection, flame detection, or any combination thereof.~~

~~28. The system according to any one of claims 1-27, further comprising outputting data associated with an optimal location for placement of the optical sensor, from which potential modes of failure can be detected.~~

~~29. The system according to any one of claims 1-28, further comprising at least one light source configured to illuminate the machine or the component thereof, and wherein classifying whether the identified change in the signals is associated with a mode of failure of the machine or the component thereof is based, at least in part, on any one or more of the placement(s) of the at least one light source, the duration of illumination, the wavelength, the intensity, and the frequency of illumination.~~

~~30.~~17. The system according to any one of claims 1-~~29~~16, wherein the system is configured to monitor a mode of failure of a screw, and further comprising:

identifying at least one segment comprising boundaries of a perimeter of the visible portion of the screw, within the received signals, such that

identifying the at least one change in the received signals comprises identifying a change or rate of change of the shape of the at least one segment;

wherein the mode of failure comprises loosening of the screw and/or rotation of the screw, and wherein generating at least one model of a trend in the identified change comprises modeling a trend in the size and/or orientation of the segment, thereby monitoring whether the screw is loosened and/or rotated.

~~31.~~18. The system according to any one of claims 1-~~29~~17, wherein the system is configured to monitor a mode of failure of a bearing, and further comprising:

identifying at least one segment comprising boundaries of a perimeter of a surface defect within the received signals, such that identifying the at least one change in the received signals comprises identifying a change or rate of change of the shape and/or propagation of the at least one segment; and

wherein the mode of failure comprises a critical defect size, and wherein generating at least one model of a trend in the identified change comprises modeling a trend in the growth of the surface defect in specific mode of operation of the bearing.

~~The system according to claim 1-32, wherein the specific mode of operation of the bearing comprises any one or more of a pressure applied to the bearing, a frequency or rotation of operation of the bearing, a speed of rotation, a duration of operation, lubricant presence, or any combination thereof.~~

~~32.~~19. The system according to any one of claims 1-18, wherein analyze dynamic movement of the machine or the component thereof comprises preventing failure of the machine or components thereof by classifying an identified a change in real time and outputting the classification of the change in real time.

~~33.~~20. A computer implemented method for monitoring a machine or a component thereof, the method comprising:

receiving signals from at least one optical sensor fixed on or in vicinity of the machine or the component thereof;

obtaining data associated with characteristics of at least one mode of failure of the machine or the component thereof;

analyzing dynamic movement of the machine or the component thereof by:

identifying at least one change in the received signals;

for an identified change in the received signals, ~~applying the at least one identified change to an algorithm configured to~~ analyze~~ing~~ the identified change in the received signals and ~~to~~ classifying whether the identified change in the received signals is associated with a mode of failure of the machine or the component thereof based, at least in part, on the obtained data; and

~~for an identified change is classified as being associated with a mode of failure,~~ outputting a signal indicative of the classification of the identified change ~~associated with the mode of failure~~.