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

the at least one 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 segment within the received signals, to be monitored;

monitoring the at least one segment,

identifying at least one change in the received signals, wherein the identifying includes detecting, within the at least one segment, one of 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; and

for an identified change in the received signals, analyzing the identified change in the received signals and 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

output a signal indicative of the classification of the identified change.

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

3. The system according to claim 2, wherein the trend comprises a rate of change in the received signals.

4. The system according to 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 2-4, 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 4-6, 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.

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.

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.

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.

11. The system according to any one of claims 1-10, 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.

12. The system according to any one of claims 1 to 11, wherein the at least one segment comprises the boundaries of a surface defect.

13. The system according to any one of claim 1-12, 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.

14. The system according to any one of claim 1-13, wherein the at least one segment comprises the boundaries of a spark.

15. The system according to any one of claims 1-14, 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.

16. The system according to any one of claims 1-15, 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.

17. The system according to any one of claims 1-16, 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.

18. 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 segment within the received signals, to be monitored;

monitoring the at least one segment,

identifying at least one change in the received signals, wherein the identifying includes detecting, within the at least one segment, one of 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;

for an identified change in the received signals, analyzing the identified change in the received signals and 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

outputting a signal indicative of the classification of the identified change.