CLAIMS

1. A method for detecting heartbeat irregularities comprising the steps of:-

a. receiving a dataset representative of at least one waveform, the at least one waveform indicative of a subject's heart activity over a predetermined period of time;

b. identifying from the data representative of at least one waveform, a plurality of peaks, each peak corresponding to a heartbeat;

c. identifying from the predetermined period of time the time occurrence of each peak;

d. calculating the difference (duration) between the time occurrence of each peak with its adjacent peak;

e. determining the difference between each duration calculated in step d;

f. classifying the absolute value of the difference into one of at least three intermediate categories; wherein each intermediate category comprises a specified range such that the absolute value is categorized into the intermediate category if it falls between the range; the intermediate categories further providing an indication of whether the subject has heartbeat irregularity.

2. A method according to claim 1, wherein the intermediate categories further provide an indication of whether the subject has normal sinus rhythm (regular heartbeat), atrial fibrillation (irregularly irregular heartbeat) or other forms of arrhythmia.

~~2~~3. A method according to claim ~~1~~2, wherein the first intermediate category of the at least three intermediate categories has a specified range of between 0 to 5; the second intermediate category of the at least three intermediate categories has a specified range of between 6 to 11; and the third intermediate category of the at least three intermediate categories has a specified range of 12 and above.

34. A method according to claim 23, wherein if all of the classified absolute values occurs in the first intermediate category, with no occurrences in the second and third categories, the at least one waveform is categorized as 'Regular heartbeat'; wherein if there are a number of occurrences |D| in all three Intermediate categories, the at least one waveform is categorized as 'Irregularly irregular' heartbeat; and wherein in all other cases the at least one waveform is categorized as 'Regularly irregular' heartbeat.

45. A method according to any preceding claims, wherein the waveform indicative of the subject's heart activity over a period of time is an arterial pulse waveform, an ECG signal or a time series of obtained camera frames captured based on variations in finger skin colour and brightness that occur due to blood pulsation.

56. A method according to claim 45, wherein where the at least one waveform is an arterial pulse waveform, the peaks are determined and identified based on the identification of dicrotic notches as well as the gradient of the upstroke and downstroke identified on the at least one waveform.

67. A method according to claim 45, wherein where the at least one waveform is a time series of obtained camera frames, the method further comprises a conversion step before step c.

78. A method according to claim 67, wherein the conversion step includes the step of accounting for the discrepancy in sampling rates across different mobile devices using the following mathematical expression:-

$$f(HR_n) = (60 \text{ seconds} \times S) / \Delta t_{n-(n+1)}$$

Wherein $f(HR_n)$ denotes beats per minute of each heartbeat, S denotes the sampling rate of the captured waveform; and $t_{n-(n+1)}$ denotes time units in milliseconds between each peak.

~~8~~9. A system for detecting heartbeat irregularities comprising

a measurement device for receiving a dataset representative of at least one waveform, the at least one waveform indicative of a subject's heart activity over a predetermined period of time;

a processor arranged to receive the dataset and further arranged to:-

identify from the at least one waveform, a plurality of peaks, each peak corresponding to a heartbeat;

identify from the predetermined period of time the time occurrence of each peak;

calculate the difference (duration) between the time occurrence of each peak with its adjacent peak;

determine the difference between each duration; and

classify the absolute value of the difference into one of at least three intermediate categories;

wherein each intermediate category comprises a specified range such that the absolute value is categorized into the intermediate category if it falls between the range; the intermediate categories further providing an indication of whether the subject has heartbeat irregularity.

10. A method according to claim 9, wherein the intermediate categories further provide an indication of whether the subject has normal sinus rhythm (regular heartbeat), atrial fibrillation (irregularly irregular heartbeat) or other forms of arrhythmia.

~~9~~11. A system according to claim ~~8~~10, wherein the first intermediate category (A) of the at least three intermediate categories has a specified range of between 0 to 5; the second intermediate category (B) of the at least three intermediate categories has a specified range of between 6 to 11; and the third intermediate category (A) of the at least three intermediate categories has a specified range of 12 and above.

~~10~~12. A system according to claim ~~9~~11, wherein if all of the classified absolute values occurs in the first intermediate category, with no occurrences in the second and third categories B and C, the at least one waveform is categorized as 'Regular heartbeat'; wherein if there are a number of occurrences |D| in all three Intermediate categories A, B and C, the at least one waveform is categorized as 'Irregularly irregular' heartbeat; and wherein in all other cases the at least one waveform is categorized as 'Regularly irregular' heartbeat.

~~11~~13. A system according to any of claim ~~8~~9 to ~~10~~12, wherein the waveform indicative of the subject's heart activity over a period of time is an arterial pulse waveform, an ECG signal or a time series of obtained camera frames captured based on variations in finger skin colour and brightness that occur due to blood pulsation.

~~12~~14. A system according to claim ~~11~~13, wherein where the at least one waveform is an arterial pulse waveform, the peaks are determined and identified based on the identification of dicrotic notches as well as the gradient of the upstroke and downstroke identified on the at least one waveform.

~~13~~15. A system according to claim ~~11~~13, wherein where the at least one waveform is a time series of obtained camera frames, the system further comprises a conversion step before the processor identify from the predetermined period of time the time occurrence of each peak.

~~14~~16. A system according to claim ~~13~~15, wherein the conversion step includes the step of accounting for the discrepancy in sampling rates across different mobile devices using the following mathematical expression:-

$$f(HR_n) = (60 \text{ seconds} \times S) / \Delta t_{n-(n+1)}$$

Wherein $f(HR_n)$ denotes beats per minute of each heartbeat, S denotes the sampling rate of the captured waveform; and $t_{n-(n+1)}$ denotes time units in milliseconds between each peak.

~~15~~17. A system according to claim ~~11~~13, wherein the measurement device is a real time beat to beat blood pressure monitoring device.

~~16~~18. A system according to claim ~~11~~13, wherein the measurement device is a mobile device with camera and flash capabilities.

~~17~~19. A mobile device having camera and flash capabilities, the mobile device operable to obtain a time series of obtained camera frames captured based on variations in finger skin colour and brightness that occur due to blood pulsation when a subject's finger is positioned against the camera lens and flash; and upon obtaining the time series detects whether the subject has heartbeat irregularity according to the method of claim ~~6~~7 or ~~7~~8.

CLAIMS

1. A method for detecting heartbeat irregularities comprising the steps of:-

a. receiving a dataset representative of at least one waveform, the at least one waveform indicative of a subject's heart activity over a predetermined period of time;

b. identifying from the data representative of at least one waveform, a plurality of peaks, each peak corresponding to a heartbeat;

c. identifying from the predetermined period of time the time occurrence of each peak;

d. calculating the difference (duration) between the time occurrence of each peak with its adjacent peak;

e. determining the difference between each duration calculated in step d;

f. classifying the absolute value of the difference into one of at least three intermediate categories; wherein each intermediate category comprises a specified range such that the absolute value is categorized into the intermediate category if it falls between the range; the intermediate categories further providing an indication of whether the subject has heartbeat irregularity.

2. A method according to claim 1, wherein the intermediate categories further provide an indication of whether the subject has normal sinus rhythm (regular heartbeat), atrial fibrillation (irregularly irregular heartbeat) or other forms of arrhythmia.

3. A method according to claim 2, wherein the first intermediate category of the at least three intermediate categories has a specified range of between 0 to 5; the second intermediate category of the at least three intermediate categories has a specified range of between 6 to 11; and the third intermediate category of the at least three intermediate categories has a specified range of 12 and above.

4. A method according to claim 3, wherein if all of the classified absolute values occurs in the first intermediate category, with no occurrences in the second and third categories, the at least one waveform is categorized as 'Regular heartbeat'; wherein if there are a number of occurrences |D| in all three Intermediate categories, the at least one waveform is categorized as 'Irregularly irregular' heartbeat; and wherein in all other cases the at least one waveform is categorized as 'Regularly irregular' heartbeat.

5. A method according to any preceding claims, wherein the waveform indicative of the subject's heart activity over a period of time is an arterial pulse waveform, an ECG signal or a time series of obtained camera frames captured based on variations in finger skin colour and brightness that occur due to blood pulsation.

6. A method according to claim 5, wherein where the at least one waveform is an arterial pulse waveform, the peaks are determined and identified based on the identification of dicrotic notches as well as the gradient of the upstroke and downstroke identified on the at least one waveform.

7. A method according to claim 5, wherein where the at least one waveform is a time series of obtained camera frames, the method further comprises a conversion step before step c.

8. A method according to claim 7, wherein the conversion step includes the step of accounting for the discrepancy in sampling rates across different mobile devices using the following mathematical expression:-

$$f(HR_n) = (60 \text{ seconds} \times S) / \Delta t_{n-(n+1)}$$

Wherein $f(HR_n)$ denotes beats per minute of each heartbeat, S denotes the sampling rate of the captured waveform; and $t_{n-(n+1)}$ denotes time units in milliseconds between each peak.

9. A system for detecting heartbeat irregularities comprising

a measurement device for receiving a dataset representative of at least one waveform, the at least one waveform indicative of a subject's heart activity over a predetermined period of time;

a processor arranged to receive the dataset and further arranged to:-

identify from the at least one waveform, a plurality of peaks, each peak corresponding to a heartbeat;

identify from the predetermined period of time the time occurrence of each peak;

calculate the difference (duration) between the time occurrence of each peak with its adjacent peak;

determine the difference between each duration; and

classify the absolute value of the difference into one of at least three intermediate categories;

wherein each intermediate category comprises a specified range such that the absolute value is categorized into the intermediate category if it falls between the range; the intermediate categories further providing an indication of whether the subject has heartbeat irregularity.

10. A method according to claim 9, wherein the intermediate categories further provide an indication of whether the subject has normal sinus rhythm (regular heartbeat), atrial fibrillation (irregularly irregular heartbeat) or other forms of arrhythmia.

11. A system according to claim 10, wherein the first intermediate category (A) of the at least three intermediate categories has a specified range of between 0 to 5; the second intermediate category (B) of the at least three intermediate categories has a specified range of between 6 to 11; and the third intermediate

category (A) of the at least three intermediate categories has a specified range of 12 and above.

12. A system according to claim 11, wherein if all of the classified absolute values occurs in the first intermediate category, with no occurrences in the second and third categories B and C, the at least one waveform is categorized as 'Regular heartbeat'; wherein if there are a number of occurrences |D| in all three Intermediate categories A, B and C, the at least one waveform is categorized as 'Irregularly irregular' heartbeat; and wherein in all other cases the at least one waveform is categorized as 'Regularly irregular' heartbeat.

13. A system according to any of claim 9 to 12, wherein the waveform indicative of the subject's heart activity over a period of time is an arterial pulse waveform, an ECG signal or a time series of obtained camera frames captured based on variations in finger skin colour and brightness that occur due to blood pulsation.

14. A system according to claim 13, wherein where the at least one waveform is an arterial pulse waveform, the peaks are determined and identified based on the identification of dicrotic notches as well as the gradient of the upstroke and downstroke identified on the at least one waveform.

15. A system according to claim 13, wherein where the at least one waveform is a time series of obtained camera frames, the system further comprises a conversion step before the processor identify from the predetermined period of time the time occurrence of each peak.

16. A system according to claim 15, wherein the conversion step includes the step of accounting for the discrepancy in sampling rates across different mobile devices using the following mathematical expression:-

$$f(HR_n) = (60 \text{ seconds} \times S) / \Delta t_{n-(n+1)}$$

Wherein $f(HR_n)$ denotes beats per minute of each heartbeat, S denotes the sampling rate of the captured waveform; and $t_{n-(n+1)}$ denotes time units in milliseconds between each peak.

17. A system according to claim 13, wherein the measurement device is a real time beat to beat blood pressure monitoring device.

18. A system according to claim 13, wherein the measurement device is a mobile device with camera and flash capabilities.

19. A mobile device having camera and flash capabilities, the mobile device operable to obtain a time series of obtained camera frames captured based on variations in finger skin colour and brightness that occur due to blood pulsation when a subject's finger is positioned against the camera lens and flash; and upon obtaining the time series detects whether the subject has heartbeat irregularity according to the method of claim 7 or 8.