Reconfiguring traditional EKG interpretation with artificial intelligence – a reliable, time-saving alternative?

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Background: Time and accuracy are key factors that may make or break an efficient triage and management in most medical premises, particularly so when expedited diagnosis saves lives - a not so uncommon scenario in the field of cardiology. By studying the different variables involved in cardiologist-EKG interactions that lead to the identification and management of different cardiovascular entities, we delved into the applications of Artificial Intelligence (AI) algorithms in order to improve upon the classic, but dated, EKG methodology. With this study, we pit our algorithm against cardiologists to perform a thorough analysis of the time invested to diagnose an EKG as Normal, as well as an assessment of the accuracy of said label.

Purpose: To present a faster and reliable AI-guided EKG interpretation methodology that outperforms cardiologists' capabilities in identifying Normal EKG records.

Methods: The International Telemedical System (ITMS) developed and tested an EKG assessing AI algorithm and incorporated it into the workflow of their Telemedicine Integrated Platform, a digital EKG reading program where cardiologists continuously report their findings remotely in real time. During the month of April 2019; 35 ITMS cardiologists reported a grand total of 61,441 EKG records, later subjecting them to the AI algorithm, implemented through the "One Click Report" process. Through this simple 2-step approach, the algorithm provides a suggestion of "Normal" or "Abnormal" to the cardiologist based on the patterns of the fiducial points included in said EKG reports. A comparison of the time of normal EKG diagnosis is made and the correlation between AI and cardiologists is assessed.

Results: On average, our AI algorithm discerned a normal EKG within 30.63s (95% CI 26.51s to 34.75s), in solid contrast with cardiologists' interpretations alone, which amounted to 83.54s (95% CI from 69.43s to 97.65s). This accounts for an overall saving of 52.91s (95% CI 42.45s to 63.83s) by implementing this innovative methodology in a cardiologist practice. In addition, this method correctly reported 23,213 Normal EKG records out of the total 25,013 AI output, reaching a 92.8% correlation between man and machine. The total average time saved in normal EKG readings with AI (23,213) would accrue an approximate of 20,470 minutes (ie, 42 8-hours work shifts worth of time dedicated to diagnosing a normal EKG).

Conclusions: The implementation of automated AI-driven technologies into daily EKG interpretation tasks poses an attractive time-saving alternative for faster and accurate results in a modern cardiology practice. By further expanding on the concept of an intelligent EKG characterization device, a more efficient and patient-centered clinical exercise will ensue.

A. Time data of studied Cardiologists on a Normal EKG detection

S.no	Cardiologists	Without AI [s]	With AI [s]	Time reduction [s]
1	Doctor A	104.99	35.97	69.02
2	Doctor B	94.42	32.63	61.78
3	Doctor C	51.44	14.35	37.08
4	Doctor D	133.69	51.19	82.50
5	Doctor E	80.30	37.94	42.37
6	Doctor F	62.55	24.97	37.58
7	Doctor G	75.70	31.72	43.98
8	Doctor H	32.18	15.82	16.36
9	Doctor I	67.14	26.84	40.30
10	Doctor J	61.60	28.03	33.57
11	Doctor K	35.97	15.77	20.20
12	Doctor L	81.49	31.90	49.59
13	Doctor M	33.59	18.22	15.37
14	Doctor N	108.90	50.37	58.53
15	Doctor O	185.67	47.25	138.42
16	Doctor P	74.85	20.99	53.86
17	Doctor Q	58.17	23.50	34.66
18	Doctor R	34.98	20.31	14.67
19	Doctor S	48.01	15.80	32.21
20	Doctor T	113.40	33.58	79.82
21	Doctor U	72.13	19.78	52.35
22	Doctor V	89.32	27.24	62.08
23	Doctor W	52.77	22.62	30.15
24	Doctor X	138.71	42.40	96.32
25	Doctor Y	62.68	24.85	37.82
26	Doctor Z	121.70	39.41	82.29
27	Doctor 1	87.67	42.27	45.39
28	Doctor 2	80.58	45.43	35.15
29	Doctor 3	64.30	21.34	42.96
30	Doctor 4	53.05	20.73	32.32
31	Doctor 5	110.00	45.95	64.05
32	Doctor 6	201.26	50.91	150.35
	MEAN	83.54	30.63	52.91

B. Statistical Results

Normal EKG - Detection time By Cardiologists

(n = 32)	Without AI	With AI	Time saved
Mean	83.54s	30.63s	52.91s
SD	39.92	11.45	30.94
SE	7.05	2.02	5.46

95% Confidence Interval

- Upper Limit 95% CI ● Mean ● Lower Limit 95% CI

EKG - Electrocardiogram, AI - Artificial Intelligence, CI - Confidence Interval, n - Sample size, SD - Standard Deviation, SE - Standard Error, s - Seconds