Machine learning – use of AI in medical dispatch

PhD project by Nikolaj Blomberg

Disclosure

No conflict of interest in relation to this research project

- Received an unrestricted research grant from TrygFoundation

- Received centre support from Laerdal

The challenge:

- EMDC in Copenhagen receives 100,000 emergency calls per year
- 1-2% are OHCAs
- Hard to gain experience and improve in OHCA recognition for the individual dispatcher
- How can we improve OHCA recognition and time to OHCA recognition?

Emergency Medical Services

FACULTY OF HEALTH AND MEDICAL SCIENCES
UNIVERSITY OF COPENHAGEN

The role of the EMDC in OHCA

Resuscitation 111 (2017) 55–61

Contents lists available at ScienceDirect

Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation

EUROPEAN RESUSCITATION COUNCIL

Clinical paper

Effect of bystander CPR initiation prior to the emergency call on ROSC and 30 day survival—An evaluation of 548 emergency calls☆

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Den Præhospitale Virksomhed

Emergency Medical Services

EMS Dispatch Center

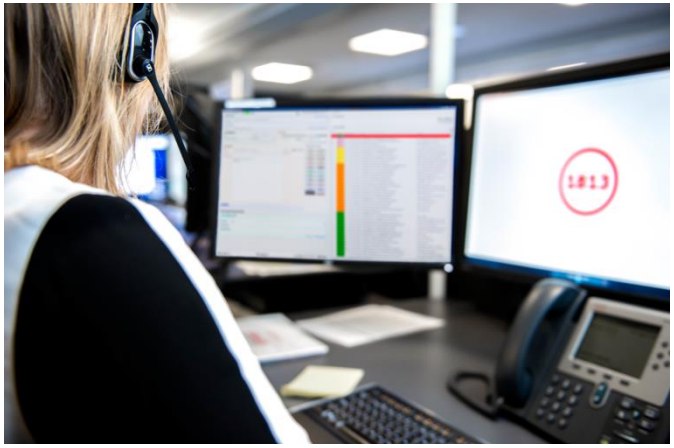
- Identified 75% of all OHCA -

Among all patients with bystander CPR:

35% started CPR before 9-1-1 call

65% started CPR during the 9-1-1 call

Still – we do not always understand what callers are telling us



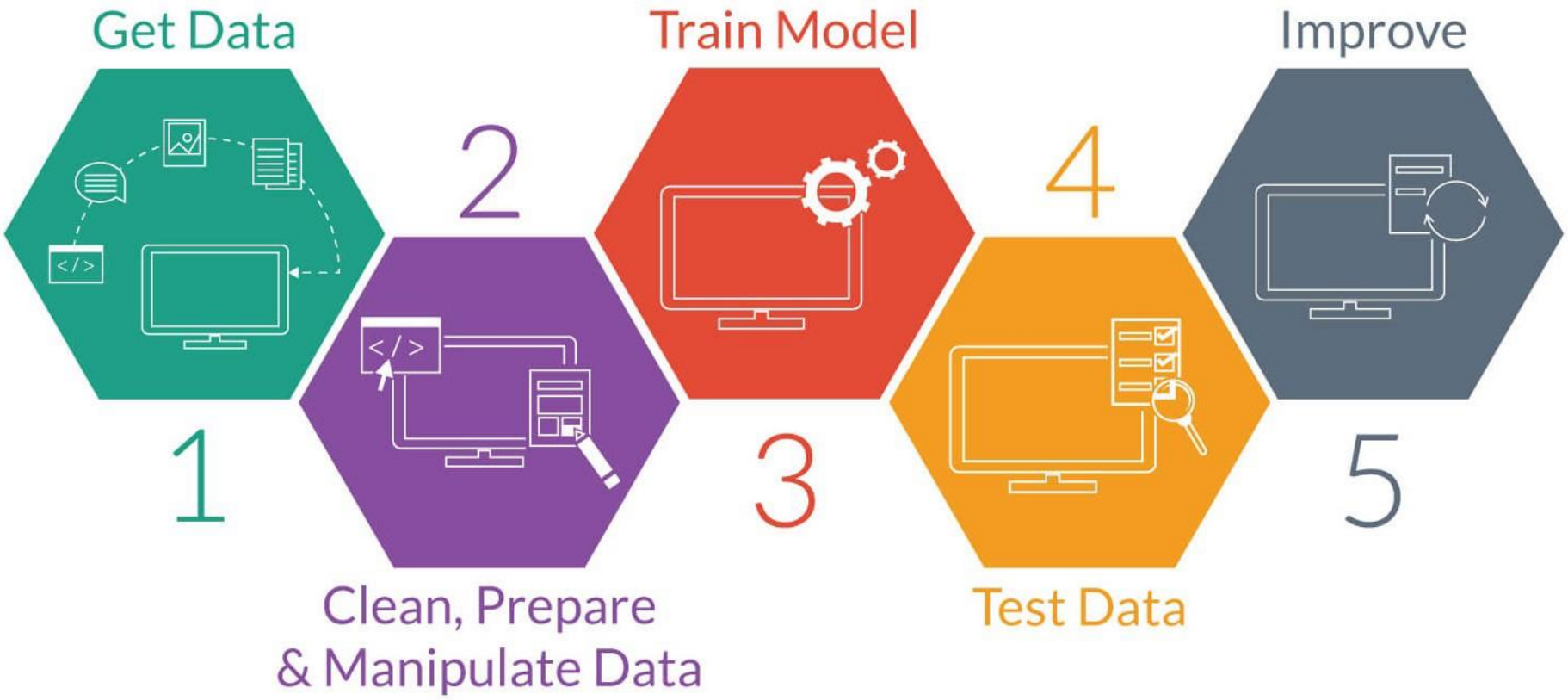
If we don't recognize cardiac arrest,

we don't provide dispatcher assisted CPR and we don't refer caller to an AED

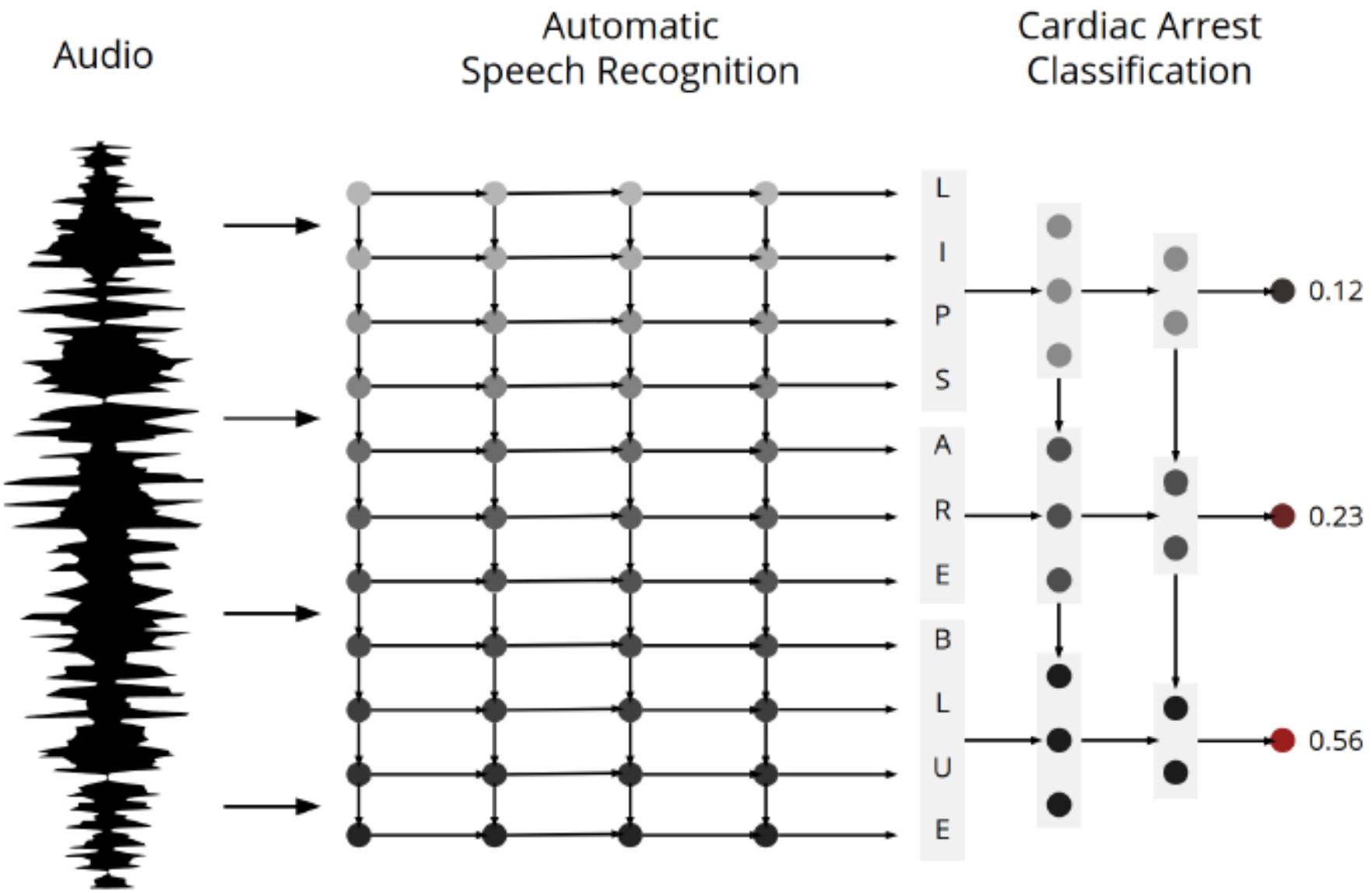
Can AI help ?
How EMDC-Copenhagen use AI

- We set out to investigate if AI can be used as a desicion support tool in medical dispatch
- It is a tool for support, not a final bottom line

The technology: Machine Learning



- The basic premise of machine learning is to build algorithms that can receive input data and use statistical analysis to predict an output value
- Machine Learning is pattern recognizion


Audio
Automatic
Speech Recognition
Cardiac Arrest
Classification
L
I
P
S
A
R
E
B
L
U
E
0.12
0.23
0.56

Raw audio data for 2014 (n = 108,607)	Machine learning framework	Dispatcher
Sensitivity (95% CI)	84.1 (81.6;86.4)	72.4 (69.4;75.3)
Specificity (95% CI)	97.3 (97.2;97.4)	98.8 (98.7-98.8)
Negative Predictive Value (95% CI)	99.9 (99.8;99.9)	99.8 (99.7;99.8)
Positive Predictive Value (95% CI)	20.9 (19.6;22.3)	33.0 (30.1;35.1)
Sensitivity (95% CI), calls unrecognized by dispatchers	44.5 (38.4-50.7)	-
Time to recognition, paired observations		
Median (seconds)	41 (38;44)	54 (50;59)
Lower quartile (seconds)	24 (22;26)	30 (28;33)
Upper quartile (seconds)	67 (63;72)	97 (89;110)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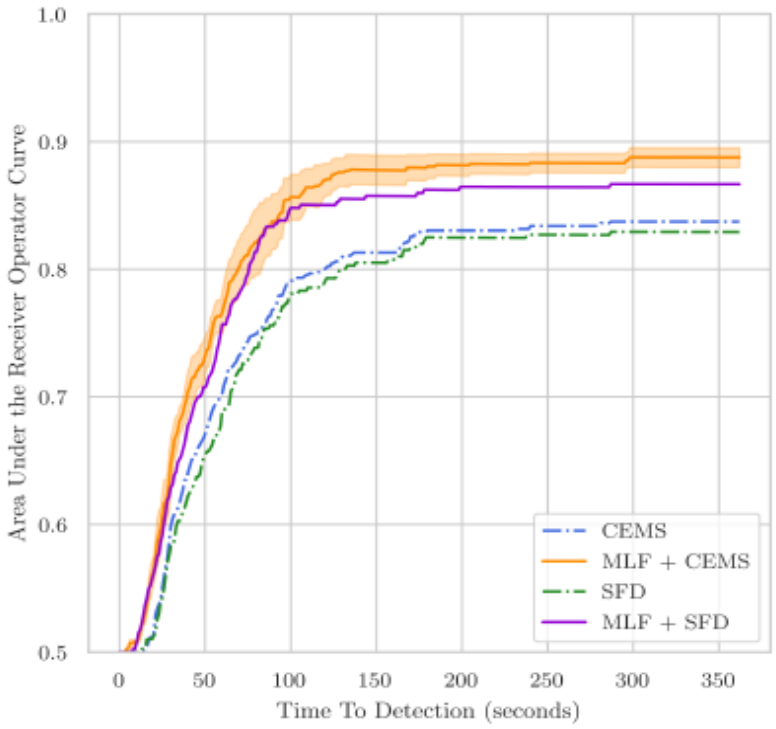
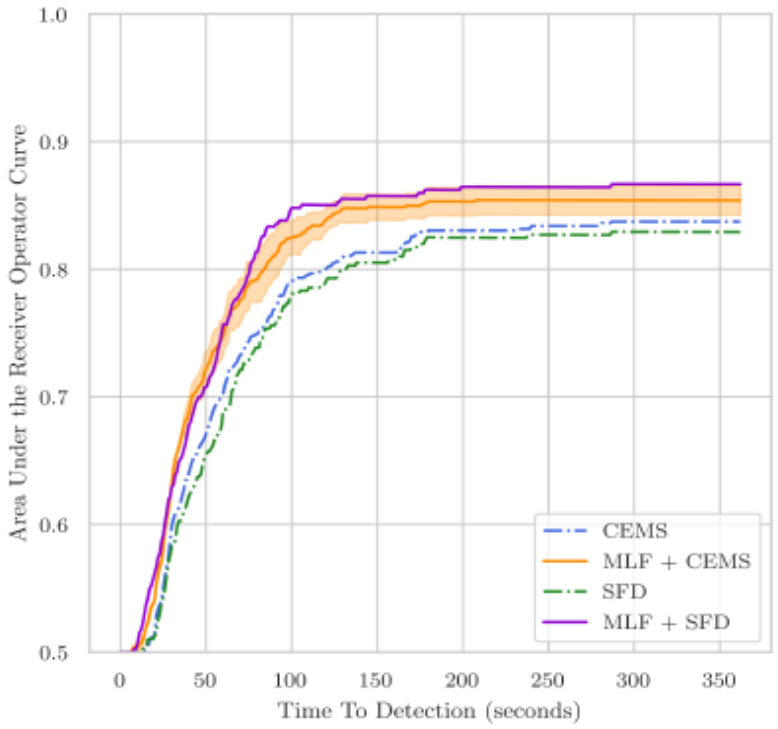

1.0
0.9
0.8
0.7
0.6
0.5
Area Under the Receiver Operator Curve
0
50
100
150
200
250
300
350
Time To Detection (seconds)
CEMS
MLF + CEMS
SFD
MLF + SFD

(a)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(b)

What it took to get here

To ”teach” the artificial intelligence

- Download >100,000 recorded calls to 1-1-2
- Identify > 2,000 calls regarding OHCA
- Make sure there are no calls on OHCA in the group not labelled OHCA

Challenges in getting here

- Download the calls – technical difficulties in downloading several hundred thousand calls
- Labelling calls – need an updated cardiac arrest registry
- Integrating the technology in the IT-infrastructure
  - We build a stand-alone device that connected directly with the phone. Ideally integrated in the dispatch system

Can AI work on live audio in clinical practice

- Prospective randomised trial
- Started september 2018
- 6 months,
- ~ 328 stops in each group
  - When the machine predicts a cardiac arrest, 50% of the alerts are shown to the dispatchers
- Alert: Dispatch A1; Dispatch HeartRunners

Thanks to:

Corti

TrygFonden

Laerdal
helping save lives