Research Topic: App development for emergency services

Leveraging AI and wearable technologies to triage emergency cases: A literature review

Introduction

The use of efficient and reliable technology can be vital in emergencies. From locating the person in need more accurately to managing emergency resources more efficiently, emergency technologies bring many benefits. This literature review focuses on solutions that help to automatically triage emergency cases. AI-assisted triage can help to deliver emergency services more efficiently and save time, which could be vital in some cases, especially considering that wearable technologies and artificial intelligence (AI) offer many opportunities to deliver personalised, effective and timely services.

This study aims to answer three research questions:

RQ1. How can AI help triage emergency cases?

RQ2. What role can consumer-grade wearable technologies play in emergency triage?

RQ3. Is it possible to automatically triage emergency cases based on data collected by consumer-grade wearable technologies and interpretation by AI more accurately than manual triage?

As the technology behind the wearable devices and AI-based applications is changing rapidly, content published before 2013 was not included in the review.

Use cases for AI to automatically triage emergency cases

AI currently has the potential to play an important role in the entire lifecycle of an emergency case, from early diagnosis based on detected symptoms to the discharge of the patient from the hospital. Among these use cases, emergency triage stands out as the most important, as it would help save valuable time and treat emergency cases more efficiently. AI can contribute to emergency triage in two ways (Chenais et al., 2023):

a. AI-assisted Self-triage: AI-based applications can help end-users determine whether they need emergency services or what type of emergency services they should seek.

b. AI-assisted Triage in Emergency Departments: Emergency services can triage a patient more quickly and efficiently using AI-based technologies.

The role of wearable technology

Wearable technology adoption rate increases exponentially with 1.8 million units shipped in the last four years (2019-2022), indicating a 381% increase compared to the previous four-year period (Statista, N.D.). In addition to the basic functionality of these devices, such as tracking time and communicating with the smartphone to which the device is connected, users are also using these devices to track their overall fitness levels (e.g. steps, distance, calories burned). Moreover, many manufacturers of consumer wearable devices also offer the possibility to monitor advanced health parameters, such as heart rate (El-Amrawy & Nounou, 2015), sleep quality (Roomkham et al., 2018), or oxygen saturation (Takahashi et al., 2022) that helps the users to assess their condition. However, the accuracy of the data gathered by consumer-grade wearable devices is usually considered questionable when compared

to medical-grade devices, as their accuracy has not been validated against standard tests such as ABG analysis (Zhang & Khatami, 2022).

However, recent studies suggest that consumer-grade wearable devices are capable of generating significantly accurate data (Chow & Yang, 2020; Pipek et al., 2021). This makes them useful tools to help the users monitor their own health.

Bringing AI and wearables together: Automatic triage based on data collected from wearable devices

Because the wearable devices provide valuable and reasonably accurate health-related data, this data can be interpreted by AI to triage emergency cases more efficiently than manually.

COVID-19 provided an opportunity to conduct a number of studies to understand whether data from wearable devices could be used for early diagnosis. Among them, Mishra et al. (2020) demonstrated how pre-symptomatic COVID-19 cases could be detected using smartwatch data, and Ates et al. (2021) highlighted the importance of the continuous data provided by wearable devices, as opposed to traditional tests in hospitals, in identifying abnormalities in one's health. These studies are a clear indication that wearable devices can be instrumental in the early detection of anomalies in one's health and, ultimately, in the automatic triage of emergency cases.

Conclusion

TBD

References:

Ates, H. C., Yetisen, A. K., Güder, F., & Dincer, C. (2021). Wearable devices for the detection of COVID-19. *Nature Electronics* 4(1): 13–14. DOI: https://doi.org/10.1038/s41928-020-00533-1

Chenais, G., Lagarde, E., & Gil-Jardiné, C. (2023). Artificial Intelligence in Emergency Medicine: Viewpoint of Current Applications and Foreseeable Opportunities and Challenges. *Journal of Medical Internet Research* 25: 40031. DOI: https://doi.org/10.2196/40031

Chow, H. W., & Yang, C. C. (2020). Accuracy of Optical Heart Rate Sensing Technology in Wearable Fitness Trackers for Young and Older Adults: Validation and Comparison Study. *JMIR mHealth uHealth* 8(4): e14707. DOI: https://doi.org/10.2196/14707

El-Amrawy, F., & Nounou, M. I. (2015). Are Currently Available Wearable Devices for Activity Tracking and Heart Rate Monitoring Accurate, Precise, and Medically Beneficial? *Healthcare Informatics Research* 21(4): 315–320. DOI: https://doi.org/10.4258/HIR.2015.21.4.315

Mishra, T., et al. (2020). Pre-symptomatic detection of COVID-19 from smartwatch data. *Nature Biomedical Engineering* 4(12): 1208–1220. DOI: https://doi.org/10.1038/s41551-020-00640-6

Pipek, L. Z., Nascimento, R. F. V., Acencio, M. M. P., & Teixeira, L. R. (2021). Comparison of SpO2 and heart rate values on Apple Watch and conventional commercial oximeters devices in patients with lung disease. *Scientific Reports* 11(1): 18901. DOI: https://doi.org/10.1038/S41598-021-98453-3

Roomkham, S., Lovell, D., Cheung, J., & Perrin, D. (2018). Promises and Challenges in the Use of Consumer-Grade Devices for Sleep Monitoring. *IEEE Reviews in Biomedical Engineering* 11: 53–67. DOI: https://doi.org/10.1109/RBME.2018.2811735

Takahashi, S., Nakazawa, E., Ichinohe, S., Akabayashi, A., & Akabayashi, A. (2022). Wearable Technology for Monitoring Respiratory Rate and SpO 2 of COVID-19 Patients: A Systematic Review. *Diagnostics* 12(10): 2563. DOI: https://doi.org/10.3390/diagnostics12102563

Statista. (N.D.). Wearables shipments worldwide 2022. Available from: https://www.statista.com/statistics/437871/wearables-worldwide-shipments/ [Accessed 4 September 2023].

Zhang, Z., & Khatami, R. (2022). Can we trust the oxygen saturation measured by consumer smartwatches? *The Lancet Respiratory* 10(5): e47–e48. DOI: https://doi.org/10.1016/S2213-2600(22)00103-5