

Domain Understanding

Creating a Trustworthy AI Model for Sepsis Detection

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literature study:

Sepsis is a life-threatening condition caused by the body's response to an infection. Early recognition and timely intervention are essential to improve patient outcomes. Machine learning models that use various clinical parameters have been developed to aid in the early detection and diagnosis of sepsis.

chosen research papers:

[Prediction of Sepsis in the Intensive Care Unit With Minimal Electronic Health Record Data: A Machine Learning Approach - PubMed \(nih.gov\)](#)

[Using Machine Learning Algorithms to predict sepsis and its stages in ICU patients | medRxiv](#)

[Frontiers | Early Prediction of Sepsis in the ICU Using Machine Learning: A Systematic Review \(frontiersin.org\)](#)

Relevant data, recommendations, and best practices based on the research papers that may be useful in creating an AI model for sepsis detection:

1. Data Gathering and Preprocessing: Developing a precise and dependable AI model for sepsis detection requires the collection of high-quality and diverse data. The model can be trained and validated using clinical data such as vital signs, test results, medication history, and demographic data. The performance of the model can be enhanced by preprocessing the data to handle missing values, outliers, and feature selection.
2. Feature engineering is a crucial stage in the creation of an AI model for sepsis detection. The accuracy and interpretability of the model can be increased by choosing pertinent clinical variables, feature scaling, and data normalization.
3. Choosing the right machine learning algorithm for the given data and problem domain is essential for creating an accurate and dependable model. In the past, sepsis has been predicted using algorithms like logistic regression, decision trees, random forests, support vector machines, and deep learning neural networks.
4. Model Evaluation: To guarantee the effectiveness and dependability of the model, a thorough evaluation of its performance is essential. The effectiveness of the model can be evaluated using metrics like sensitivity, specificity, accuracy, positive predictive value, negative predictive value, and area under the receiver operating characteristic (ROC) curve.
5. Clinical Implementation: Careful attention must be given to a number of issues before using the AI model in clinical practice, including the integration with electronic health records, clinical workflow, and decision-making process. Clinicians must be able to grasp the model's explanations and predictions in order to use it to guide their decisions.
6. Ethics: While creating and applying AI models for sepsis detection, ethical issues such as data protection, security, and informed permission must be carefully taken into account. Building confidence and acceptability among clinicians and patients

depend on ensuring transparency, fairness, and accountability in the model's creation and application.

Overall, these contextual details, recommendations, and best practices may be useful in creating a precise and trustworthy AI model for sepsis identification. To increase the model's efficacy and usefulness in clinical practice, it is critical to continuously review and update it based on fresh data and feedback from doctors and patients.

Co-reflection:

Me: "Setting an innovative course for my AI model for sepsis detection, in my opinion, is crucial. To develop a more precise and trustworthy model, I should encourage creativity and openness to new ideas among stakeholders."

Lachezar Mitov: "I completely agree. In the design process, you should prioritize creativity and experimentation to explore new and innovative approaches to sepsis detection. This involves engaging with stakeholders, such as clinicians and patients, to understand their needs and perspectives, and co-creating solutions that meet their requirements. It's also important to embrace failure as an opportunity to learn and improve the model, rather than a setback."

Me: "That's a great point. Involving stakeholders in the design process can help me identify unmet needs and design solutions that are more relevant and usable. I should also be open to new technologies and approaches that can enhance the model's performance and effectiveness."

Lachezar Mitov: "Exactly. Keeping an eye on emerging technologies and trends can help you stay ahead of the curve and develop a model that is both innovative and effective. You should also continuously evaluate the model's performance and seek feedback from stakeholders to ensure its relevance and usefulness in clinical practice."

The co-reflection as a whole emphasizes the value of establishing an innovative direction in the design process of the AI model for sepsis detection, encouraging experimentation and creativity, involving stakeholders, and continuously evaluating and improving the model. These procedures can aid in the development of a more precise and trustworthy model that satisfies the requirements of clinicians and patients and enhances sepsis detection and management.

Interview:

I conducted an interview with a medical professional (a nurse working in MBAL "St. Karidal") The interview was conducted in Bulgarian, below you can see it structured and translated to English

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1. How can medical professionals collaborate with AI developers to ensure that the sepsis prediction model is developed and implemented in a way that meets the needs of patients and healthcare providers?

Medical professionals can provide expertise in sepsis diagnosis and treatment, while AI developers can provide the technical knowledge for building the prediction software. The collaboration should involve regular communication, data sharing, and feedback to ensure that the model is accurate, reliable, and user-friendly.

2. How do you currently diagnose sepsis, and what are the diagnostic criteria that you use?

Sepsis diagnosis is based on several criteria: clinical signs, and laboratory tests.

We use a combination of criteria which include the following: suspected infection, an increase in the Sequential Organ Failure Assessment (SOFA) score, and the amount of lactic acid in the blood.

- Are there any challenges or limitations with the current diagnostic criteria for sepsis, and how do you overcome them?

One of the main challenges with sepsis diagnosis is that the symptoms are often nonspecific and can be attributed to other conditions, which can lead to delayed diagnosis and treatment. To overcome this challenge we, need to be highly suspicious of sepsis and run the necessary diagnostic procedures.

- How quickly can sepsis be diagnosed once a patient presents with symptoms, and does this impact treatment decisions?

The time to diagnosis can vary depending on the severity of symptoms and the availability of already conducted diagnostic tests on the patient that indicate a possibility of sepsis. The prompt diagnosis of sepsis is crucial because early intervention can improve patient outcomes. Treatment decisions are based on the severity of sepsis, the presence of organ dysfunction, and the underlying cause of infection.

- What are some of the common mistakes or errors that can occur in the diagnosis of sepsis, and how do you prevent them?

Common mistakes in diagnosing sepsis include overlooking milder symptoms, misinterpreting diagnostic tests, and failing to recognize the severity of illness. To prevent these mistakes, we are mindful of the subtle symptoms of sepsis and have a standardized approach to diagnosis and treatment.

3. How do you currently use technology or data to support sepsis diagnosis and treatment, and what improvements would you like to see in this area?

we do not currently use any software that can tip us in the right direction of diagnosing sepsis, from which we can benefit.

4. What are some of the more subtle symptoms that may indicate sepsis?

- confusion and/or altered mental status
- hypotension
- tachypnea (rapid breathing)
- tachycardia (rapid heartbeat)

5. Are there any specific patient populations or types of infections that are more likely to lead to sepsis?

Any type of infection can potentially lead to sepsis.

There is no correlation between ethnicity and a higher risk of developing sepsis