AI model predicting intention out of bed

Intention out of bed prediction with AI

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Context of use: Education
Level of education: Master

Impact on society

What impact is expected from your technology?

What is exactly the problem? Is it really a problem? Are you sure?

Currently, in nursing home care, elderly residents are at risk of experiencing bed falls when trying to get out of bed unassisted or developing decubitus from lying down for too long when help is delayed. The primary goal of this project is to notify caregivers earlier by predicting with AI when residents show an intention to get out of bed, enabling timely assistance. This can help reduce the risks of falls and the chance of developing decubitus caused by prolonged immobility.

Are you sure that this technology is solving the RIGHT problem?

Yes, it addresses part of the problem by helping caregivers detect when residents are likely to get out of bed. This can reduce the chance of bed falls and ensures they get help at the right time. By acting earlier, it also prevents residents from staying immobile for too long, which can contribute to decubitus development. The system is intended as an assistance tool for caregivers, not a replacement, especially in a sector already facing staff shortages.

How is this technology going to solve the problem?

It will not solve anything directly, but it will indirectly. This technology will assist caregivers by predicting when residents show an intention to get out of bed. Caregivers can respond based on the notifications, reducing the reliance on fixed-timer check-ins and helping residents at the right moments. By preventing delays in assistance, the system indirectly reduces the risk of falls and prolonged immobility, which could lead to decubitus.

What negative effects do you expect from this technology?

There is a risk that some managers might view this as a way to reduce staffing, even though the goal is to assist caregivers, not replace them. Another concern is if the system generates too many false positives or misses real events, it could disrupt routines or reduce trust in the technology. These risks can be managed by improving the systems accuracy and clearly communicating its intended purpose.

In what way is this technology contributing to a world you want to live in?

This technology contributes to a better care environment by helping caregivers act earlier when residents need assistance, reducing risks like falls. By preventing long periods of immobility, it also lowers the chance of

decubitus. It ensures residents get timely care and helps caregivers focus their attention where its most needed.

Now that you have thought hard about the impact of this technology on society (by filling out the questions above), what improvements would you like to make to the technology? List them below.

The current timespan of 3 days is not enough to detect reliable patterns. More data is needed over a longer period to improve accuracy. It would also help to gather more details about resident behavior and health conditions, as these factors can affect predictions. Improvements will focus on refining detection thresholds and ensuring caregivers get accurate and timely notifications.

Hateful and criminal actors

What can bad actors do with your technology?

This category is not applicable for this technology.

Privacy

Are you considering the privacy & personal data of the users of your technology?

Does the technology register personal data? If yes, what personal data?

Raw sensor data and type of mattress currently.

Do you think the technology invades the privacy of the stakeholders? If yes, in what way?

No, there have been agreements made on how all the stakeholders should handle the data and what needs to be done to secure the privacy of the residents and other stakeholders.

The data received is also anonymous, from my side it is unable to track back who who is, but from other stakeholders, the back tracking is possible.

Is the technology is compliant with prevailing privacy and data protection law? Can you indicate why?

I use data that is available from other stakeholders, which protect the privacy and data of the residents (so yes). The stakeholders handle with discretion. As the more data can help with predicting, it is important to get as many data as possible without being able to backtrack who the resident is. As for creating new data based on the existing data, it would be compliant due to being unable to backtrack the data and as all the data that is available is necessary to do what is expected of the project and all the data is relevant.

Does the technology mitigate privacy and data protection risks/ concerns (privacy by design)? Please indicate how.

The collection of data which is available is the bare minimum and the features that can be created out of this is also the bare minimum as based on the existing features new features will create that are able to help with the prediction process.

In which way can you imagine a future impact of the collection of personal data?

The technology can get data from stakeholders that do follow throughout their lifetimes, as residents in a nursing home care are at the end of their life expectancy. It will not do anything with their reputation, the only that will be done with the data is help to create a system that will help current and future residents into making their experience better by helping the nurses when to intervene.

Now that you have thought hard about privacy and data protection, what improvements would you like to make? List them below.

I do not think I can make any improvements currently as everything I have data wise that can be backtracked to the resident has been anonymized, other data does not say much in its own, so there is nothing to being able to done with them.

Human values

How does the technology affect your human values?

How is the identity of the (intended) users affected by the technology?

Residents will be positively impacted by the system, as it reduces unnecessary check-ins while ensuring timely interventions when they show an intention to get out of bed. This helps maintain their privacy and dignity while balancing caregiver efficiency with resident safety. Predictions are currently informed by expert input and literature, with efforts focused on minimizing false alerts that could disrupt residents unnecessarily.

How does the technology influence the users' autonomy?

The technology is designed to enhance the autonomy of residents by enabling more accurate detection of their intentions to get out of bed. By notifying caregivers when assistance is needed, it ensures residents receive timely help without unnecessary interruptions. This allows residents to maintain a sense of independence while ensuring their safety. For caregivers, the system empowers them to make informed decisions based on detected behaviors, either providing assistance or observing when it is safe to let the resident act independently.

What is the effect of the technology on the health and/or well-being of users?

If the technology works as expected, it will improve the health and well-being of residents by enabling timely caregiver interventions when they show an intention to get out of bed. This reduces the risk of bed falls and minimizes prolonged immobility, which can contribute to the development of decubitus. As the technology is still in development, it will need to be tested carefully to ensure its predictions are accurate and provide real benefits. Any issues will require refinement to ensure the system delivers on its goals effectively.

Now that you have thought hard about the impact of your technology on human values, what improvements would you like to make to the technology? List them below.

The current dataset is limited, which impacts prediction accuracy. Collecting more data over a longer period is essential to improve the system's ability to detect intentions to get out of bed. Hidden variables, such as resident health conditions and behaviors, also need to be better understood. Collaboration with experts will help refine detection thresholds and improve predictions. These steps will ensure the system minimizes false alerts while maintaining the safety and well-being of residents.

Stakeholders

Have you considered all stakeholders?

This category is only partial filled.

Who are the main users/targetgroups/stakeholders for this technology? Think about the intended context by answering these questions.

Name of the stakeholder
Momo Medical

How is this stakeholder affected?
This stakeholder is the one that gathers all the data from the residents of Avoord and tanteLouise which are using a device from Momo Medical to assist the staff. The technology that is currently being underdevelopment will likely be an addition to the current device they are currently using to assist the staff of Avoord and tanteLouise.

Did you consult the stakeholder?
Yes

Are you going to take this stakeholder into account?
Yes

Name of the stakeholder
Avoord

How is this stakeholder affected?
This stakeholder is an institution which has locations for residents that require assistance with living. The residents in those institutions have devices from Momo Medical which assist the staff with their daily activities. It also uses mattresses from Q Care, which help with reducing possible complications of decubitus due to the mattress technologies and availability they have.

Did you consult the stakeholder?
Yes

Are you going to take this stakeholder into account?
Yes

Name of the stakeholder
tanteLouise

How is this stakeholder affected?
This stakeholder is an institution which has locations for residents that require assistance with living. The residents in those institutions have devices from Momo Medical which assist the staff with their daily activities. It also uses mattresses from Q Care, which help with reducing possible complications of decubitus due to the mattress technologies and availability they have.

Did you consult the stakeholder?
Yes

Are you going to take this stakeholder into account?
Yes

Name of the stakeholder
Q Care

How is this stakeholder affected?
This stakeholder is a specialist of decubitus and also has products that can help reduce the development of decubitus due to the mattress technology. Q Care can be contacted to help nursing home care institutions all over the Netherlands to help with stabilizing decubitus or providing treatment to heal from it. They can also be contacted to learn to nursing home care staff how they can prevent and treat decubitus better.

Did you consult the stakeholder?
Yes

Are you going to take this stakeholder into account?
Yes

Did you consider all stakeholders, even the ones that might not be a user or target group, but still might be of interest?
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Now that you have thought hard about all stakeholders, what improvements would you like to make? List them below.
I would like to more about resident behaviour, which is currently not taken to account well. I have reached out to Avoord and tanteLouise to get an insight on resident behaviour, as it has a lot of impact on development of decubitus. But I have not been able to have a meeting with them. This needs to happen in the future as insights on how residents behave will improve the predictions a lot as right now we expect residents to follow certain rules and do certain behaviour which is not always the case.

Data

Is data in your technology properly used?

Are you familiar with the fundamental shortcomings and pitfalls of data and do you take this sufficiently into account in the technology?

Yes, the dataset currently only consists of 3 days of sensor data from residents, which makes it difficult to detect consistent patterns for intentions to get out of bed. Most data points show residents in bed, and there is not enough information about when they intend to move or health conditions that might influence this. These limitations are taken into account by working with expert input and focusing on improving data collection in the future.

How does the technology organize continuous improvement when it comes to the use of data?

Right now, the technology is in the early stages, so continuous improvement has not been fully implemented yet. This will likely change over the next 3 to 6 months as the project moves into new phases. The focus will be on improving the data and refining predictions based on feedback from experts and caregivers. Initial building blocks are being established now to support these improvements.

How will the technology keep the insights that it identifies with data sustainable over time?

The system will train models to make predictions, and these models will need to be retrained regularly to stay accurate as resident behaviour changes or new residents are added. As long as relevant data continues to be collected, the insights will remain sustainable. The group of stakeholders is committed to solving the issues in nursing home care together, so the risk of losing data availability is minimal.

In what way do you consider the fact that data is collected from the users?

The data is collected to help improve residents lives by ensuring they only receive assistance when needed. By learning from their behaviour, the system can reduce unnecessary interruptions and alert caregivers when its the right time to intervene. This ensures that the data is used in a way that directly benefits residents.

Now that you have thought hard about the impact of data on this technology, what improvements would you like to make? List them below.

I would like to gather more data on different types of behaviour for each mattress type to group residents based on mattress behaviour. This would allow predictions to be made within smaller, more specific groups, improving accuracy. Currently, there are large groups with big differences that cause less accurate predictions. Additionally, collecting data over a longer time span would also help improve the system.

Inclusivity

Is your technology fair for everyone?

Will everyone have access to the technology?

When used, it will only be available for Momo Medical as the technology will be used in their devices. Residents of Avoord and tanteLouise will be using the new technology of the device. If any updates are needed, contact will be made to adjust the system to better suit the residents or improve its functionality.

Does this technology have a built-in bias?

The system is focused on detecting when a resident is in bed and identifying intentions to get out of bed. Since it uses a limited dataset, there is a built-in bias that assumes generalized behaviour across different residents and mattress types. These biases will be reduced by collecting more data and refining the system with input from caregivers and experts.

Does this technology make automatic decisions and how do you account for them?

Currently, it does not make automatic decisions yet, but those can be made if the right settings are on, which can be done on request. All the possible automatic decisions that can be done will be shared with the location instances that decide to turn it on. I can currently not foresee if there will be any biases, ideally there shouldn't be any. There might be biases towards elderly that are in terrible state, as you can only get in a nursing home currently if the state a resident is in is terrible.

Is everyone benefitting from the technology or only a a small group? Do you see this as a problem? Why/why not?

Everyone should be benefitting from it as it will reduce the workload of nursing homes a lot if executed correctly so they can focus on other things that need to happen. As the group of elderly is only going to get bigger, it is better to solve this issue on a smaller scale first and based on that stepping up in order to help even a bigger group.

It should be a win win for everyone, although a stakeholder thinks it will replace staff, which will not happen as there is a shortage of staff for a long time and firing people will not help with that. It will create an opportunity to do more with less.

Does the team that creates the technology represent the diversity of our society?

Currently, the technology only checks the state of the resident with the current available knowledge and data, so currently it is not diverse. This will change in the future due to more knowledge in behaviour and background information, as this will create diversity of interpretation of residents and will cause making diverse actions to make decisions and predictions.

Now that you have thought hard about the inclusivity of the technology, what improvements would you like to make? List them below.

I would like to be able to create even more diversity with the predictions, as resident behaviour is different and cannot be directly be grouped into big groups. It should look at the location of an institution, the residents in there and based on that make decisions based on turned on settings.

Transparency

Are you transparent about how your technology works?

Is it explained to the users/stakeholders how the technology works and how the business model works?

The concept of predicting intentions to get out of bed is straightforward to explain, but the underlying technology is complex and requires context to fully understand. To build trust, caregivers and stakeholders will be provided with clear explanations of how the system generates predictions and how it should be used in care settings. While details about the integration with Momo Medicals BedSense system remain out of scope, general transparency about the technologys functionality will be prioritized.

If the technology makes an (algorithmic) decision, is it explained to the users/stakeholders how the decision was reached?

All the decisions that will be made will be explained in how they are made and why and the goal of the made decision as clarity is important, so the stakeholders know how every decision is being made. This will be explained in documents and during presentations. In case of an update, the new logic will be shared.

Is it possible to file a complaint or ask questions/get answers about this technology?

Yes, it is possible to file a complaint or raise questions. As we're currently in the early stages of developing the technology, is it important to do share them directly and to not wait for them. Currently, I am the only one working on the project. The goal is to create an environment that people can work in together, if this environment is ready, it might be the time to work on it with multiple people.

Is the technology (company) clear about possible negative consequences or shortcomings of the technology?

Yes, as it is currently under development, it has a lot of shortcomings. The goals are to understand these shortcomings and to work on them. All the shortcomings will be documented, including what needs to happen to cover the shortcomings.

Now that you have thought hard about the transparency of this technology, what improvements would you like to make? List them below.

I would like to be more transparent in how the thresholds are being calculated and in how the system decides when a intention out of bed is

being detected. This is important as it decides a lot on how the predictions currently is being handled.

Sustainability

Is your technology environmentally sustainable?

This category is not applicable for this technology.

Future

Did you consider future impact?

What could possibly happen with this technology in the future?

In the future, the system could significantly impact caregiving by shifting from reactive check-ins to proactive interventions. By detecting intentions to get out of bed in real-time, caregivers can focus their attention where it is most needed, reducing fall risks and improving overall safety. As the system evolves, it will also aim to predict risks like decubitus development, enabling more comprehensive resident care.

Sketch a or some future scenario (s) (20-50 years up front) regarding the technology with the help of storytelling. Start with at least one utopian scenario.

In the future, when a resident is lying down in their bed in a nursing home, they will be using technology that can detect based on their behaviour when a nurse should check upon them. All the information of the resident is being used to help current residents and future residents to minimize the unnecessary check-ins of the nurses so they can help others instead. As the system is more reliable, they can count on the systems more and work with and around them to do everything that is expected to be done.

Sketch a or some future scenario (s) (20-50 years up front) regarding the technology with the help of storytelling. Start with at least one dystopian scenario.

Because of the learnt system based on resident data, nurses are checking residents at more appropriate times when they are likely to be in need of assistance or at better suited times when a nurse should be checking upon residents.

Would you like to live in one of this scenario's? Why? Why not?

Yes, because in those scenarios, more time can be spent on resident that are in more of a need. In case of when a resident has direct needs, other technologies are being available that can help them with other needs.

What happens if the technology (which you have thought of as ethically well-considered) is bought or taken over by another party?

If the company decides to continue with the project, nothing will happen to it. If they decide to hold back on the data or the group cooperation, it will cause the project to stop. As this will benefit the nursing home care a lot, I do not foresee this project to stop any time soon.

Impact Improvement: Now that you have thought hard about the future impact of the technology, what improvements would you like to make? List them below.

In the future the technology should only focus on the residents that are or have been in this location to be able to make their predictions as all the knowledge and actions should be taken should be done by residents that are or were known by the nurses. If data outside the instances is being delivered, it could lead to negative impact. And if the decision is being made to make it so it can be used globally, a lot of training needs to be done.