Automated laboratory

The RobotLab project is driven by the need to revolutionize the way chemical mixtures are designed and synthesized by combining machine learning and artificial intelligence

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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?
The challenge is the inefficiency of traditional chemical mixture design methods, which are based on trial and error in experiments. This work innovates chemists, industries, and consumers. By streamlining processes through AI-driven analysis and increased experimentation, the technology seeks to enhance product development, benefiting various industries and society at large by accelerating innovation.

Are you sure that this technology is solving the RIGHT problem?
Yes, it is addressing the right problem. Even when talking about the future/ long-term solution. This problem can solve many solutions, and contribute to the overall knowledge of humans.

How is this technology going to solve the problem?
The laboratory can keep executing experiments (no human needed), and it can keep going through the night. The laboratory can think of new experiments quicker than any human ever would.

What negative effects do you expect from this technology?
New mixtures can be created that could be weaponized or be harmful in any way to humans.

In what way is this technology contributing to a world you want to live in?
It will bring the quantity of experiments way higher. So more questions can be answered.
It can revolutionize the way we are currently living, in ways that we can't even imagine.

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.
Maybe create a better plan for possible applications of the robotlab

Hateful and criminal actors
What can bad actors do with your technology?

In which way can the technology be used to break the law or avoid the consequences of breaking the law?
The technology implemented in RobotLab, is intended for scientific advancements and improving efficiency in research. However, the technology can be misused. For instance, using AI to manipulate experimental outcomes might lead to falsified research, potentially violating laws and regulations in scientific research and product development

Can fakers, thieves or scammers abuse the technology?
They could manipulate data, which can result in falsified research.

Can the technology be used against certain (ethnic) groups or (social) classes?
I don't see any possible misuse of the technology against ethnic or social classes.

In which way can bad actors use this technology to pit certain groups against each other? These groups can be, but are not constrained to, ethnic, social, political or religious groups.
I don't see any possible misuse of the technology against any specific group.

How could bad actors use this technology to subvert or attack the truth?
Using AI to manipulate experimental outcomes might lead to falsified research, potentially violating laws and regulations in scientific research and product development.

Now that you have thought hard about how bad actors can impact this technology, what improvements would you like to make? List them below.
Watch out for the training data that is used for training the AI.

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?

Yes, personal data on who was involved in the experiment.

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

No

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

Yes. There are some exceptions in GDPR when handling scientific data supposed to personal data. Names can be reused when scientific data is reused, as long as specific conditions are met.

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

Anonymizing the data, create contracts when sharing data and implement access control.

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

The data on who was involved in each experiment can be visible.

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

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Human values
How does the technology affect your human values?

How is the identity of the (intended) users affected by the technology?
The users are saved in a data management framework. Their names can be seen by an AI, or groups who request data.
Scientists who like to conduct experiments, might not be able to follow their passion as much, as experiments will be conducted automatically.

How does the technology influence the users' autonomy?
Decisions about what experiments will be conducted can be made by an AI.
It could be seen as addictive, when thinking of the fast rate of new experiments that can be conducted.

What is the effect of the technology on the health and/or well-being of users?
The technology can be frighting to people, as we give a physical robot with AI the control to conduct their own experiments. People can be scared of a technology like that.

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.
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Stakeholders
Have you considered all stakeholders?

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

Name of the stakeholder
Research Group

How is this stakeholder affected?
Researchers can research something, and automatically run an experiment on it, to test if it is correct.

Did you consult the stakeholder?
No

Are you going to take this stakeholder into account?
No

Name of the stakeholder
Chemical Scientists

How is this stakeholder affected?
Chemical Scientists normally performed experiments by hand, and thought of the experiments themselves. The RobotLab does this work for them, the scientists only have to confirm the validity of the experiment

Did you consult the stakeholder?
No

Are you going to take this stakeholder into account?
No

Name of the stakeholder
Data scientists

How is this stakeholder affected?
Data scientist get to work with this technology. They can help analyze the data and train the AI to work best in its environment.

Did you consult the stakeholder?
No

Are you going to take this stakeholder into account?
No

Did you consider all stakeholders, even the ones that might not be a user or target group, but still might be of interest?

Name of the stakeholder
Unknown

How is this stakeholder affected?
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Did you consult the stakeholder?
No

Are you going to take this stakeholder into account?
No

Now that you have thought hard about all stakeholders, what improvements would you like to make? List them below.
Make sure to let everyone know what they are getting in to. It is a new concept, so we have to explain it carefully, and make sure everyone agrees with the data contracts.

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 RobotLab project acknowledges fundamental data challenges such as bias or incompleteness. Implementing trategies like data cleaning is vital to mitigate these issues.

How does the technology organize continuous improvement when it comes to the use of data?
Yes, the idea of the RobotLab project is to continuously use the new data, combine it with the other data, and think of new experiments.
The continuous flow of data is one of the main challenges of the RobotLab project.

How will the technology keep the insights that it identifies with data sustainable over time?
At the end of this semester, I hope to have better insight for this issue.

In what way do you consider the fact that data is collected from the users?
Personal data is not traded in this technology, the data is merely used to acknowledge involved scientists.

Now that you have thought hard about the impact of data on this technology, what improvements would you like to make? List them below.
At the end of this semester, I hope to have better insight for this issue.

Technology Impact Cycle Tool

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Inclusivity

Is your technology fair for everyone?

Will everyone have access to the technology?
No, only partners of the RobotLab project.

Does this technology have a built-in bias?
The technology itself doesn't intentionally have bias. However, biases can emerge from the data used to train it. If the training data is incomplete, the AI models developed within the RobotLab project could reflect those biases.

Does this technology make automatic decisions and how do you account for them?
Yes, the technology thinks of new experiments to conduct. That is the entire idea of the RobotLab project.

Is everyone benefitting from the technology or only a a small group? Do you see this as a problem? Why/why not?
The results, generated in the RobotLab project, could be beneficial to everyone on the long term, as the new technologies/ innovations that come forward from the results of the experiments can be used to solve day to day problems.

Does the team that creates the technology represent the diversity of our society?
No, the team that creates the technology are only highly educated personnel, which does not reflect on the real world.

Now that you have thought hard about the inclusivity of the technology, what improvements would you like to make? List them below.
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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?
Not applicable yet, as the RobotLab project is still in its early stages.

If the technology makes an (algorithmic) decision, is it explained to the users/stakeholders how the decision was reached?
Not applicable yet, as the RobotLab project is still in its early stages.

Is it possible to file a complaint or ask questions/get answers about this technology?
Not applicable yet, as the RobotLab project is still in its early stages.

Is the technology (company) clear about possible negative consequences or shortcomings of the technology?
A chemist or researcher will conduct less experiments themselves, this could have a negative impact on the knowledge of the chemist, as simple experiments could become unfamiliar.

Now that you have thought hard about the transparency of this technology, what improvements would you like to make? List them below.
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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?
RobotLab might see other branches copy the technology in various industries beyond chemistry. It could revolutionize research methodologies, leading to quicker innovation in product development.

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.
Utopian 30 years: New chemical mixtures are discovered at a rapid pace, people live longer, healthier and happier because of this.

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.
Dystopian 30 years: New chemical mixtures are discovered, but they can only be used by those who contributed to the project with either effort or money. The gap between the rich and the poor does not only affect medicine or healthcare anymore.

Would you like to live in one of this scenario's? Why? Why not?
Yes, because utopian is good for everyone, and I contributed to the dystopian, so it would be good for me.
However, I want everyone to benefit equally of the technology, disregarding the money of effort that they have put into it.

What happens if the technology (which you have thought of as ethically well-considered) is bought or taken over by another party?
It could be used to create chemical mixtures that can be weaponized. (Tear gas / Mustard gas)

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.
Maybe make agreements at the start on how results of experiments will be used.