Large Scale 3D printing

Large scale FGF prints suffer from being printed in an unregulated process. Due to differences in layer temperature the layer adhesion gets compromised (cold lower layer) or sagging occurs (hot lower layer). Both situations compromise the quality, mechanical and geometric properties of the print. To solve this the printing speed is controlled through a PI controller that receives temperature data from a thermal camera. The controller ensures that the speed of the nozzle extrudes the next layer when the previous layer is at the ideal temperature.

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Context of use: Education
Level of education: Bachelor

Impact on society

What impact is expected from your technology?

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

Large scale FGF prints suffer from being printed in an unregulated process. Due to differences in layer temperature the layer adhesion gets compromised (cold lower layer) or sagging occurs (hot lower layer). Both situations compromise the quality, mechanical and geometric properties of the print. To solve this the printing speed is controlled through a PI controller that receives temperature data from a thermal camera. The controller ensures that the speed of the nozzle extrudes the next layer when the previous layer is at the ideal temperature. This reduces the rate of failed prints, making research in LSAD cheaper and faster.

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

The root cause of the problem is different heat dissipation rates throughout a print that cause inconsistencies in layer adhesion and sagging rates. Variable printing speed is probably the best way to tackle this problem.

How is this technology going to solve the problem?

By dynamically adjusting nozzle speed during prints, making sure the layer below is at it's ideal temperature before extruding the next layer.

What negative effects do you expect from this technology?

Since it is a standalone system with multiple components on different parts of the printing room it adds clutter to the area.

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

This technology reduces the rate of failed prints, making the research process on LSAM faster and cheaper as well as improving the overall quality of the prints.

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.

Have it integrate deeper with the printer instead of working as a standalone system.

Hateful and criminal actors

What can bad actors do with your technology?

This category is only partial filled.

In which way can the technology be used to break the law or avoid the consequences of breaking the law?

The technology can not be used in any way to break the law or avoid the consequences of breaking the law.

Can fakers, thieves or scammers abuse the technology?

No

Can the technology be used against certain (ethnic) groups or (social) classes?

No

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.

None.

How could bad actors use this technology to subvert or attack the truth?

This question has not been answered yet.

Now that you have thought hard about how bad actors can impact this technology, what improvements would you like to make? List them below.

This question has not been answered yet.

Privacy

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

This category is only partial filled.

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

The technology does not register any kind of personal data. It only stores thermal imaging data that is stored locally on the user's computer. This data is not sensitive and the protection of said data falls on the owner of the computer.

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, no personal data is gathered.

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

No

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

This question has not been answered yet.

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

This question has not been answered yet.

Human values

How does the technology affect your human values?

This category is only partial filled.

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

This technology controls the print speed, something that was previously done manually by an operator. By taking that task away from the operator, the operator can focus on improving other aspects of the printing process.

How does the technology influence the users' autonomy?

No influence

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

No influence

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.

This question has not been answered yet.

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
LSAM Research group at Fontys

How is this stakeholder affected?
Their pace of their work will improve as they have less failed prints and can conduct better experiments.

Did you consult the stakeholder?
Yes

Are you going to take this stakeholder into account?
Yes

Name of the stakeholder
Fontys budget management team

How is this stakeholder affected?
They will have to spend less on the LSAM Research Team as it is more efficient.

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
LSAM manufacturers and researchers

How is this stakeholder affected?
Might be interested of acquiring this system as a product to improve their own LSAM system.

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.
This question has not been answered yet.

Data

Is data in your technology properly used?

This category is only partial filled.

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

Thermal imaging data has some degree of inaccuracy. It has a most accurate reading distance but, when angled, not all points in the print will be at that distance and not all will have the same accuracy.

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

This question has not been answered yet.

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

This question has not been answered yet.

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

Data is not collected

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

Accuracy can be improved by dynamically changing the position of the camera to get the best point of view. Some degree of data inaccuracy is accounted for and worked around it.

Inclusivity

Is your technology fair for everyone?

This category is only partial filled.

Will everyone have access to the technology?

No, only the LSAM Research group at Fontys

Does this technology have a built-in bias?

Yes. This project is bias in the sense that previous groups have already worked on improving it and most of the improvements come from following up on what they started.

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

It does make automatic decisions based on thermal image data. The decision process is explained in the design report.

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

Just the Research Group at Fontys will benefit from it. That's not a problem because it's not a product for the public.

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

It does to some extent having people from different countries and cultural backgrounds.

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

This question has not been answered yet.

Transparency

Are you transparent about how your technology works?

This category is only partial filled.

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

Yes. The design report will be available to researchers, teachers and students at Fontys. It includes all the information about the goals it solves, the idea behind it and a detailed explanation on how the technology works.

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

Yes

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

Yes, team members can be contacted through Microsoft Teams to provide answers.

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

Yes, there's some inaccuracy on the gathered data and in the way data is processed. This is transparently communicated with stakeholders.

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

This question has not been answered yet.

Sustainability

Is your technology environmentally sustainable?

This category is only partial filled.

In what way is the direct and indirect energy use of this technology taken into account?

Energy use is not taken into account as this is not an energy intensive process. The system uses minimal energy to function and no energy is being wasted. Improvements in energy efficiency are pointless.

Do you think alternative materials could have been considered in the technology?

Probably, but only 1 unit is being built so the environmental impact of the materials chosen is not relevant.

Do you think the lifespan of the technology is realistic?

The lifespan of this technology is determined by the state of the art of the control system. It will not degrade as fast as it will become obsolete.

What is the hidden impact of the technology in the whole chain?

Hidden impact is minimal since all the materials used for this technology are reusable. The camera goes back to the manufacturer when not in use. And mechanical components can be scavenged and used in other applications. It doesn't consume big amounts of electricity or fuels.

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

This question has not been answered yet.

Future

Did you consider future impact?

This category is only partial filled.

What could possibly happen with this technology in the future?

A widespread implementation of this system wouldn't have a huge impact on communities, habits or norms. It would mainly accelerate the research on LSAM and reduce the overall costs of both research and manufacturing making LSAM a more attractive manufacturing method for companies.

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.

Due to the fast advancements in LSAM, industry started shifting gradually from conventional manufacturing methods to 3D printing. The technology vastly outclassed the rest of manufacturing methods and drastically reduced the lead times and costs for parts. Large scale products got cheaper and more affordable for everyone increasing the quality of life of people around the world.

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.

Due to fast advancements in LSAM, industry implemented 3D printing technology as the main manufacturing method. This led to a industrial revolution that increased the demand of plastic over other materials, skyrocketing the demand of fossil fuels to produce plastic and the environment suffered greatly. Manufacturing companies didn't want to reduce their production which led to a huge loss of wildlife, habitable soil and quality of life for humans.

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

This question has not been answered yet.

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

This question has not been answered yet.

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.
This question has not been answered yet.