

# Sea Slug Classification

Detecting Sea Slugs using CNN models.

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Level of education: Bachelor

# Technology Impact Cycle Tool

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## Impact on society

What impact is expected from your technology?

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

The main problem that the idea aims to address is the need for the divers at Blauwtipje to efficiently identify certain types of sea slugs. Although the divers have collected images of these sea slugs, the process of manual identification is time-consuming and can be error prone.

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

By utilizing deep learning techniques, the application aims to streamline the identification process, making it faster and more reliable than manual identification. This will save time and effort for the divers but also enable users to gain a better understanding of the sea slugs they encounter.

The problem indicated by Blauwtipje is that the manual identification process is very slow and error prone, while mainly being accessible to experts. As such, the solution solves the problem they have indicated.

### How is this technology going to solve the problem?

The technology is going to solve the problem by automating the identification process using image classification.

### What negative effects do you expect from this technology?

The technology may encourage over fishing or other practises which may harm marine life.

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

A slow and tedious process which is error prone can be automated using the power of artificial intelligence.

### 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.

Ensure the technology is only accessible to experts who aim to balance and improve marine life, as opposed to the general population who may use it to cause harm.

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## 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 can not directly be utilised to break the law. However, the detection of certain species in protected areas could encourage illegal fishing or diving.

### **Can fakers, thieves or scammers abuse the technology?**

If the technology misclassifies certain sea slugs, bad actors could attempt to make profit or harm protected species.

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

The technology could create bias, as our iteration will only be used to identify 5 types of sea slugs.

### **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.**

Not Applicable.

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

If bad actors discover that one species of sea slugs is always or frequently misclassified as another type of sea slug, they could use the technology to confirm their claim.

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

The owners of Blauwtipje may benefit in keeping the technology restricted to marine biologist experts.

The technology could only classify sea slugs above a certain confidence level, to reduce misclassifications. In addition to the classification, marine biologists may benefit in seeing which features the technology used to identify the sea slug.

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## 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?**

If the technology is limited to marine biologist experts, the system has to store login details, but no additional personal data.

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

Not applicable.

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

Yes. Passwords would be encrypted and the system would permit deletion of accounts.

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

Not applicable.

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

The location in which pictures are taken may benefit the technology in classifying sea slugs. However, this location would not have to be stored, and solely send over HTTP requests, which can be encrypted.

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

Not applicable.

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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?

If this technology is accessible to the general public, the barrier of being an expert at identifying sea slugs becomes a lot lower.

This may indirectly harm marine biologists, who have spend a lot of time learning how to manually identify sea slugs based on their characteristics.

### How does the technology influence the users' autonomy?

The users' autonomy is influenced by identifying sea slugs automatically as opposed to manually. While it remains possible to manually identify the sea slugs, users are more likely to blindly trust the model.

Over time, users may become worse at manually detecting sea slugs, as they won't practise doing so nearly as much.

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

Not applicable.

### 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.

By including an explanation of how a detected sea slugs can be manually identified, users are encouraged to check whether the model detected the correct sea slug. Furthermore, users could be informed of how the model identified a sea slug.

This also benefits users by staying in the habit of manually identifying sea slugs.

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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

Blauwtipje Marine Biologists

### How is this stakeholder affected?

The marine biologists will use the technology to identify sea slugs more efficiently and more accurately.

### Did you consult the stakeholder?

No

### Are you going to take this stakeholder into account?

Yes

### Name of the stakeholder

Blauwtipje.nl hobbyists

### How is this stakeholder affected?

If granted access to the technology, hobbyists will be given a way to identify sea slugs with very limited domain knowledge.

### 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

Data Challenge Teachers

### How is this stakeholder affected?

The data challenge teachers are the main contact point of the developers of the technology. They will judge the students on their performance and function as bridge the students and biologists.

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Did you consult the stakeholder?

Yes

Are you going to take this stakeholder into account?

Yes

**Now that you have thought hard about all stakeholders, what improvements would you like to make? List them below.**

Not applicable.

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### 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 number of images per sea slug species is limited to 200 to 300. In addition, there are currently only sufficient images of 5 species of sea slugs, which is why we will limit the technology to these species.

It is also possible that other species of animals could be misclassified as certain sea slugs.

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

When images of sea slugs are uploaded and classified, users could give feedback on whether they believe the classification is correct.

Correctly classified sea slug images could be stored to improve future models.

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

When users upload their own images of sea slugs for classification purposes, they may need to give permission for the image to be stored and used in future models.

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

Users benefit from sharing their data as it can improve the model. The aim of the technology is not to make a profit.

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

We may give users the option to upload their own images, so the model can be improved over time.



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## Inclusivity

Is your technology fair for everyone?

### **Will everyone have access to the technology?**

It is yet to be determined whether everyone will have access to the technology. While it would be nice to allow hobbyists to use the technology, it also causes a greater risk of bad actors abusing the technology.

### **Does this technology have a built-in bias?**

The collected images could contain a built in bias, based on how the images are taken, the (under water) conditions such lighting and water clarity, the amount of images per species and the number of species.

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

The technology gives a suggestion or prediction of the animal species, but does not make any decisions based on this prediction. The technology accounts for the prediction by explaining why it made the decision that it did, and providing information of how the predicted species can be identified.

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

This is yet to be determined. More than likely, all users of Blauwtipje will have access to the technology, which would also make it accessible to bad actors.

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

The question is not very applicable to us, as we are working as a very small team (duo). As far as the duo goes, we have diverse backgrounds and IT expertises.

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

During the development, we would like to keep bias based on image quality in mind, and consider whether this matches realistic scenarios.

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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?**

The technology will be explained on a basic level that is understandable to users without domain knowledge of artificial intelligence.

In addition, predictions can be clarified using heatmaps and or features which the model takes into consideration to make the system more transparent.

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

Yes, the user will be shown a visualisation that explains the model's prediction, as well as a confidence level.

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

Any future complaints will have to be forwarded to and handled by Blauwtipje, as they will receive the final product.

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

The technology is clear about the bias, limited data and limited number of species that it is able to classify.

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

Ensure the transparency is implemented through heatmaps and/or a confidence level that is shared with the end user.

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## Sustainability

Is your technology environmentally sustainable?

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

The direct and indirect use of the technology consists of server power to build the models, update the models in the future, and host the model.

Building the models is a one time investment on our laptop, which use relatively little energy. Seeing as Blauwtpje already hosts their website, hosting the model should not cause a significant larger load.

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

Not applicable.

### **Do you think the lifespan of the technology is realistic?**

While species change over time, this change is very slow. Assuming a model can abstract the species well, it should require minimal changes in the coming century.

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

The images need to be taken, which requires cameras and a multitude of divers go enter the sea life. Divers, as well as hobbyists, could disturb the sea life while gathering pictures or while using the technology.

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

We see few ways to improve the sustainability of this technology.

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## Future

Did you consider future impact?

### What could possibly happen with this technology in the future?

Wildlife habits could be disturbed, which could cause a reduction in the population. The environment could also be polluted, as divers may lose items in the water.

### 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 year 2043, the technology to identify species of sea slugs using image classification has reached unprecedented levels of accuracy and efficiency. Marine biologists, conservationists, and citizen scientists all over the world use this technology to monitor and protect sea slug populations in their respective regions.

With the help of drones and underwater cameras equipped with this technology, researchers can easily identify and track sea slugs in their natural habitats. This has led to a greater understanding of the ecological roles of sea slugs and their relationships with other marine organisms.

### 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.

In the year 2057, the technology to identify species of sea slugs using image classification has become a tool for corporate greed and exploitation. Private companies have patented the technology and use it to gain a monopoly over the fishing industry.

They use drones and underwater cameras equipped with this technology to locate and harvest sea slugs in massive quantities, without regard for their ecological impact. The once-abundant sea slug populations have now been decimated, and the oceans are suffering as a result.

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

Yes, the utopian scenario. The greater understanding of marine organisms is beneficial, as it can help to preserve the oceans. This has a great impact on the environment as a whole.

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

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See dystopian scenario.

**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.**

Seeing as we are building the technology for an external partner, it is difficult to influence the use of the technology in the long term.