Open Universiteit

Activities of the Center for Actionable Research of the Open University

Dr Stefano Bromuri

About CAROU

Actionable research, Co-creation and Education

Supporting the Digital Age

Brightlands
Smart Services Campus

Research partners

apg
morgen is vandaag

DHL
EXPRESS

zuyderland

AME

PGGM

BETAWERK

TATA STEEL

appsforce

accenture

POLITIE
INNOVATIE LAB

RWTH AACHEN
UNIVERSITY

Research Activities

- Logistics
- Service Industry
- Healthcare
- Material Sciences, Physics and the environment
- And more, this presentation represents a selection, we have many activities ongoing

Logistics

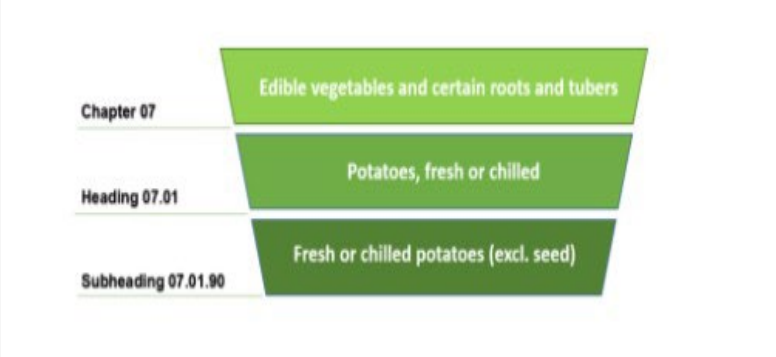
Researchers
Dr. Stefano Bromuri
Dr. Murat Firat Dr.
Deniz Iren

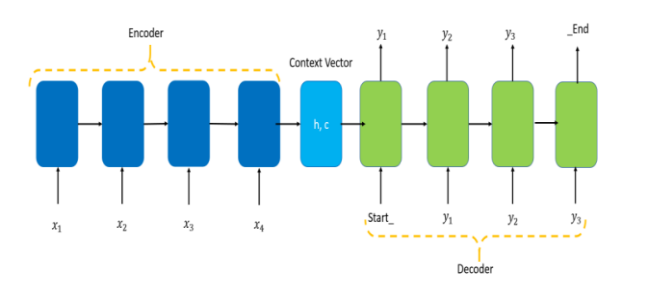
HS-Codes (Quality) Prediction

The HS-Codes Encoder/Decoder model has been Deployed in DHL to predict HS-CODES associated with International shipments.

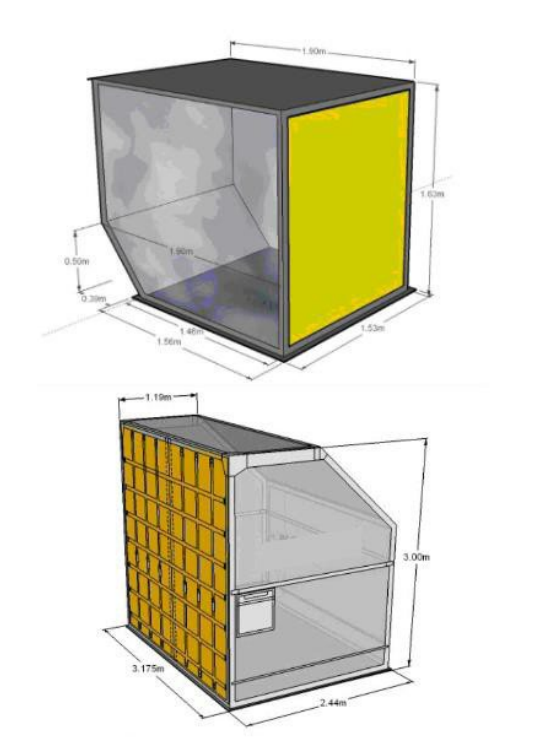
HS-CODES Are required by the law,
and are usually manually inserted depending on the description inserted by the customer.

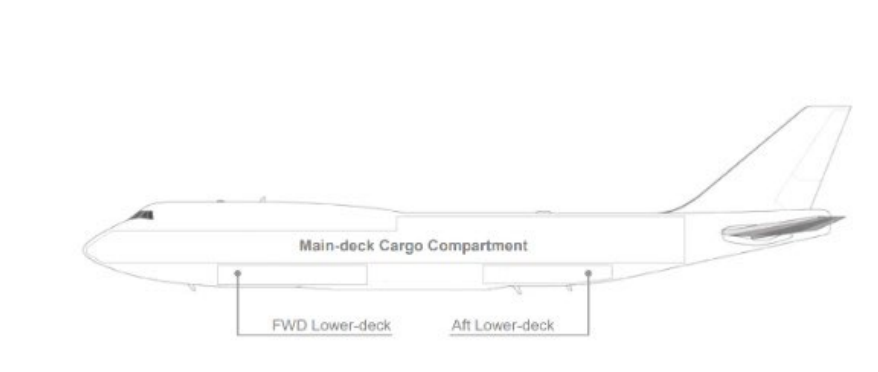
The proposed solution allowed us to automatize 20% of all the shipments and to score the description quality of 100% of the shipment

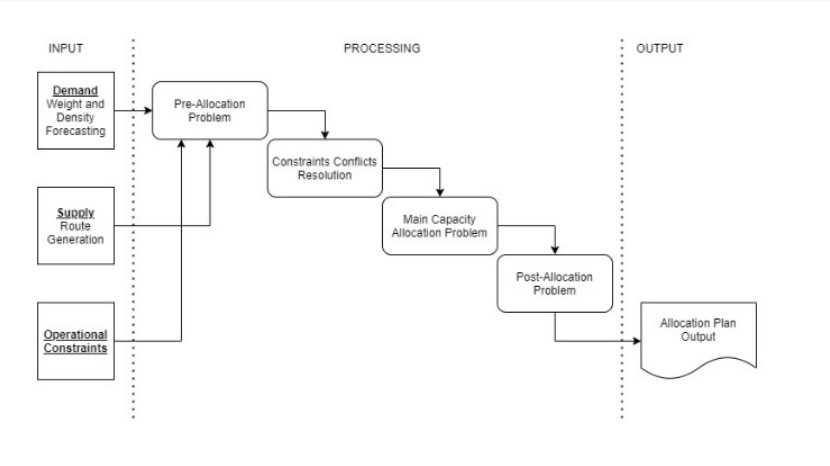




ULD Load Optimization







Service Research and Affective Computing

Dr. Alex Henkel Dr.

Deniz Iren

Dr. Stefano Bromuri

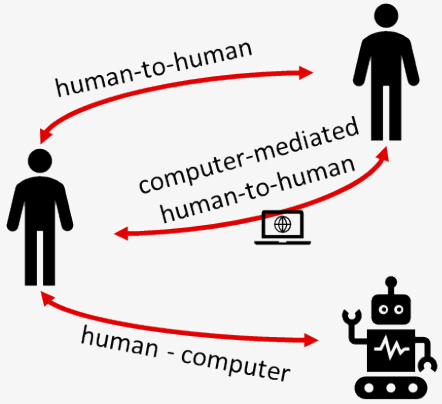
Affective Computing Research Line at CAROU

CONTEXT

- Emotions are an essential part of human communication
- They are vital for building social relationships as well as human survival
- Emotions have a strong influence on decision-making

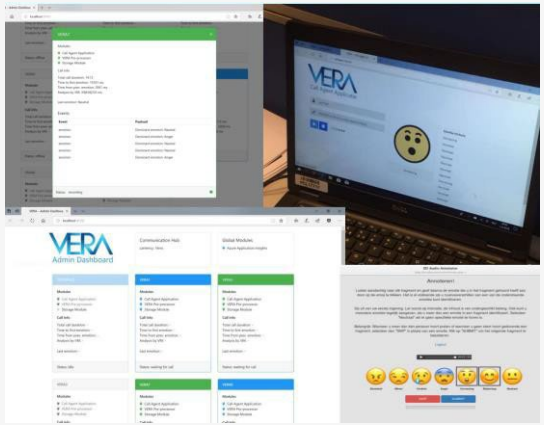
PROBLEM

- Independent of shape and form, computers are devoid of emotions and empathy
- Computer-mediated human-to-human communication hinders emotional displays and perception
- Innate human emotional abilities are far from mastery



Affective Computing Research Line at CAROU

VERA: Voice Emotion Recognition Assistant

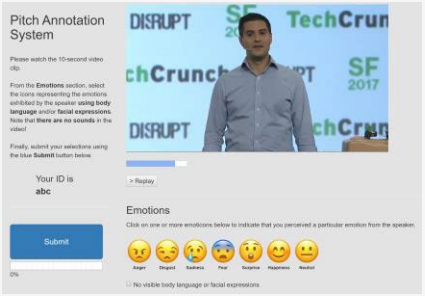


Speech-Emotion Recognition for stress detection in a call centre

Henkel, A. P., Bromuri, S., Iren, D., & Urovi, V. (2020). Half human, half machine–augmenting service employees with AI for interpersonal emotion regulation. *Journal of Service Management*.

Bromuri, S., Henkel, A. P., Iren, D., & Urovi, V. (2020). Using AI to predict service agent stress from emotion patterns in service interactions. *Journal of Service Management*.

Techcrunch Emotions



What are the emotional display patterns in successful entrepreneurial presentations?
Dataset: Annotated Techcrunch Pitch Dataset

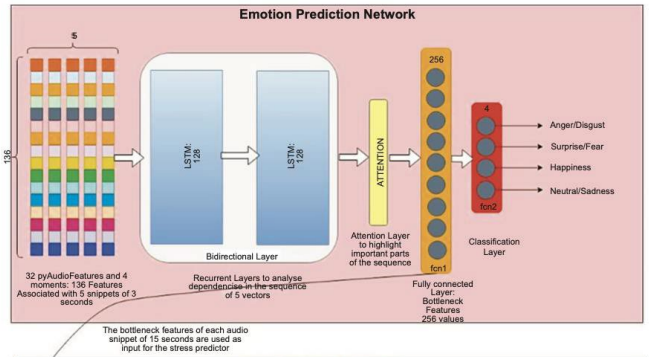
Carnevale, J. B., Javadian, G., Ormiston, J., Iren, D., Bromuri, S., Zhan, S.... (2020). Emotions and Entrepreneurship: The Road Traveled, Boundary Conditions, and New Approaches. In *Academy of Management Proceedings* (Vol. 2020, No. 1, p. 17464). Briarcliff Manor, NY 10510: Academy of Management.

EBI: Empathic Business Intelligence

Can we analyze the conflict between what is said and how it is said to uncover additional information in quarterly earnings calls?
Dataset: Annotated Quarterly Earnings Call Dataset

Iren, D., Bromuri, S., Ebrahim, M. & Geelen, P. (2018, November). The Effect of Emotional Cues on Making Economic Decisions under Uncertainty. In *INFORMS Annual Meeting*.

AI to predict the stress level of service employees in customer service interactions



Service agent stress from emotion patterns

Note(s): The first network uses speech features calculated with PyAudioAnalysis to perform a prediction of the 4 emotion labels. The penultimate layer of the emotion network (fc1) is implemented with RELU neurons and is connected with then final layer of the network (fc2), that is a fully connected softmax layer outputting the probability of an emotion. The stress prediction network uses the output of fc1 of the first network to calculate the probability of stress in the full call

Figure 3. LSTM-based architecture for speech emotion recognition

Source: Bromuri, Stefano; Henkel, Alexander P.; Deniz, Iren; Urovi, Visara (2021), "Using AI to Predict Service Agent Stress from Emotion Patterns in Service Interactions," *Journal of Service Management*, 32(4), 581-611.

Speech Emotion Recognition in Customer Service

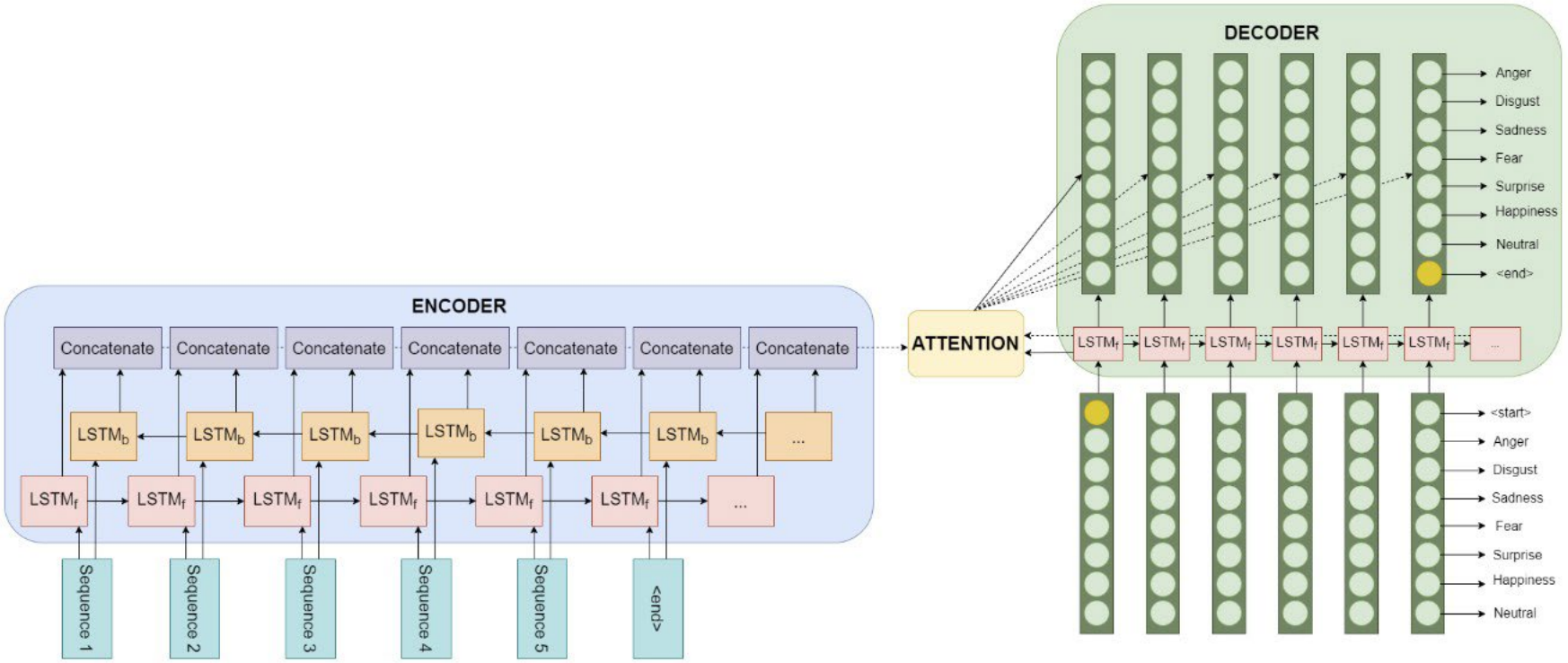


Fig. 1. NMT Architecture

Waelbers, Bea; Bromuri, Stefano; Henkel, Alexander P., "Comparing Neural Networks for Speech Emotion Recognition in Customer Interactions", *forthcoming in Proceedings of 2022 IEEE World Congress on Computational Intelligence IJCNN.*

AI to augment service employees in customer service interactions

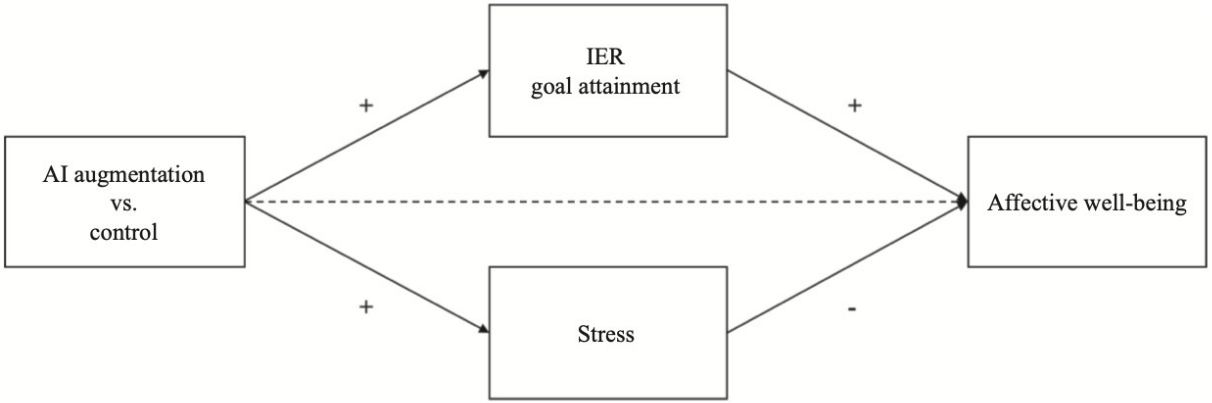
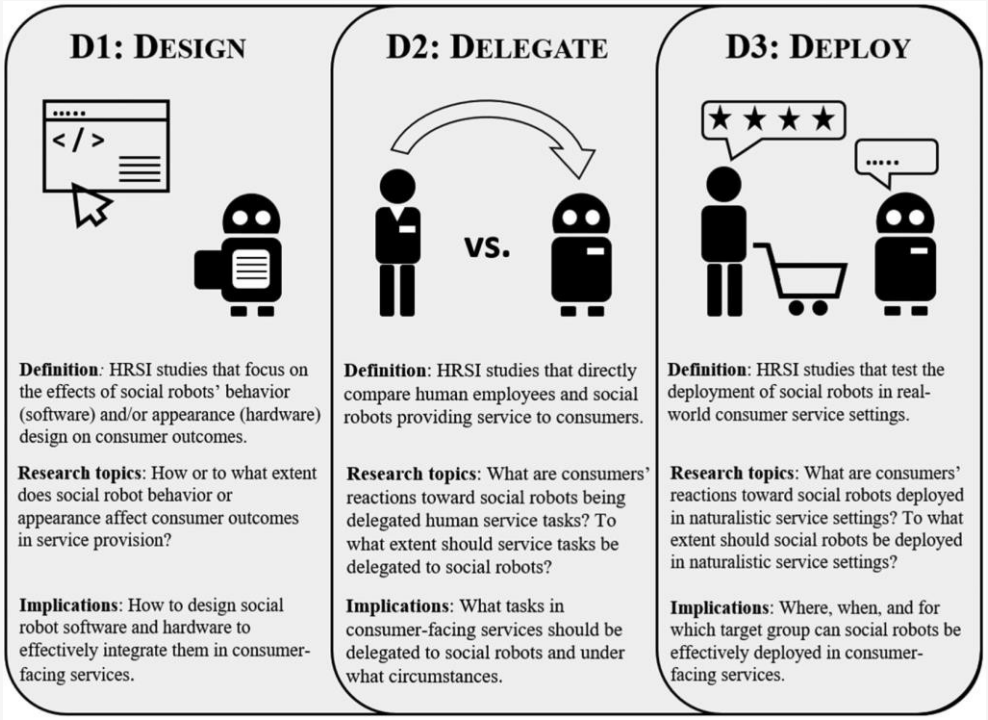


Figure 2.
Main theoretical model representing H2A and H2B

Note(s): The upper path, associating AI augmentation with a positive effect on affective well-being represents *H2A*, the lower path, depicting the negative effect on affective well-being through increased levels of stress, represents *H2B*

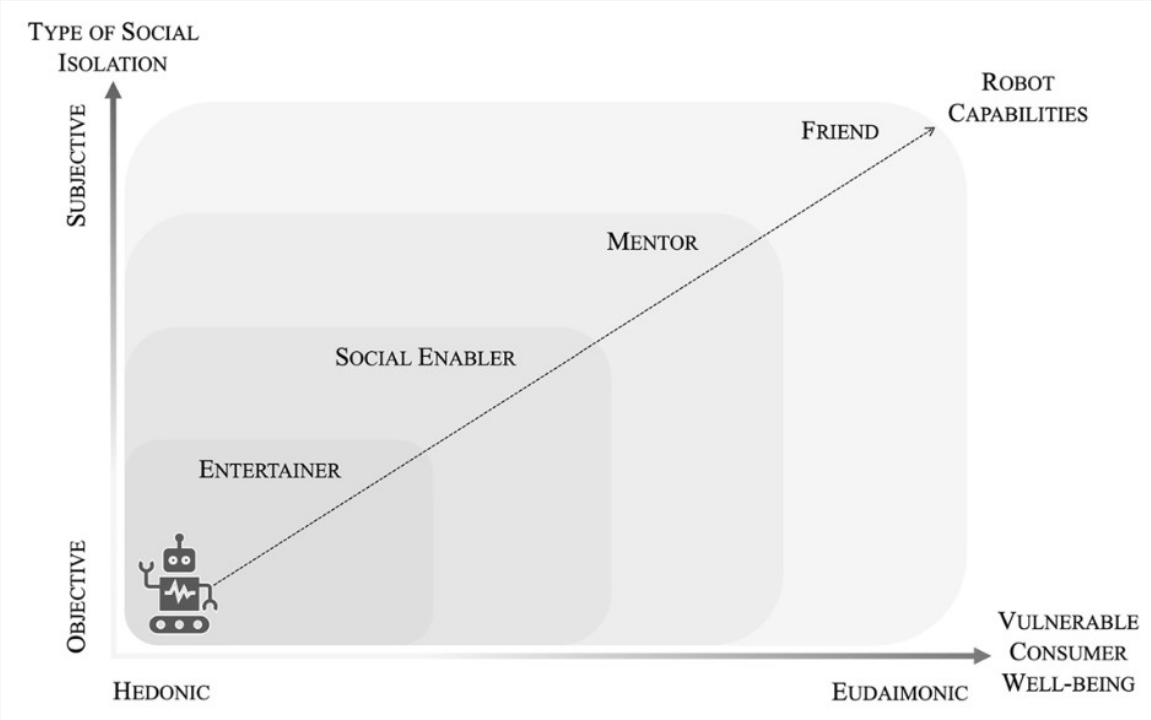
Henkel, Alexander P.; Bromuri, Stefano; Iren, Deniz; Urovi, Visara (2020), "Half human, half machine—Augmenting service employees with AI for interpersonal emotion regulation," *Special Issue on AI and ML in Service Management at Journal of Service Management*, 31(2), pp. 247-265.

Social robots in a service context



Source: Blaurock, Marah; Caic, Martina; Okan, Mehmet; Henkel, Alexander P. (2022), "A transdisciplinary review and framework of consumer interactions with embodied social robots: Design, delegate, deploy", *forthcoming in International Journal of Consumer Studies.*

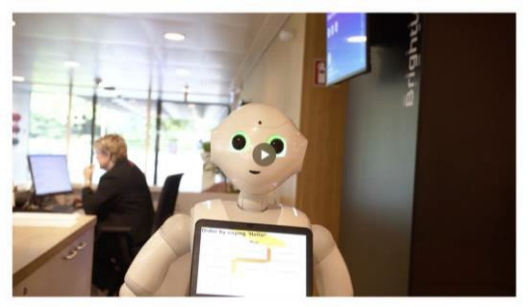
Social robots to advance consumer well-being



Source: Henkel, Alexander P.; Caic, Martina; Blaurock, Marah; Okan, Mehmet (2020), "Robotic Transformative Service Research: Deploying Social Robots for Consumer Well-being During COVID-19 and Beyond," *Journal of Service Management*, 31(6), pp. 1131-1148.

Consequences of automating service with AI (e.g., chatbots, robots) for consumers' firm evaluations

VS.



Source: on-going project

Material Sciences, Physics and Environment

Dr. Lyana Curier

Dr. Deniz Iren

Dr. Stefano Bromuri

Steel Defects Dataset (Available in Nature Scientific Data)

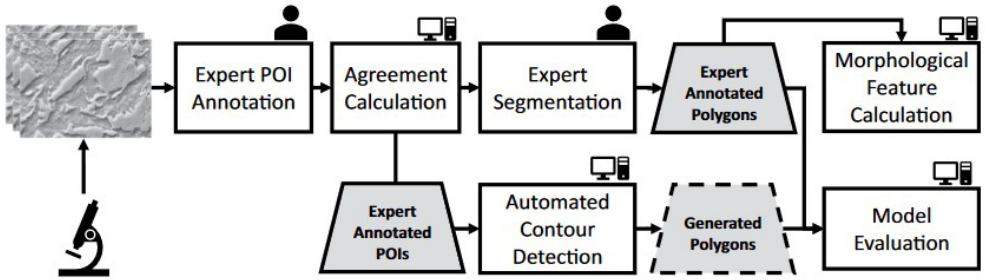


Fig. 1 The steps of the data generation process. The images of various steel samples were acquired via a scanning electron microscope. The MA islands that appear on these images were annotated redundantly by multiple experts as points-of-interest (POI). The set of POIs was refined into a smaller set based on the agreement of the experts using the spatial proximity of the individual annotations. Subsequently, the experts drew polygons on the boundary of the MA islands that were previously marked by the majority of experts. The agreed-upon POIs were also used to guide the automated contour detection around the MA islands. The generated polygons were benchmarked against the expert-annotated polygons. Finally, the morphological characteristics of expert annotated polygons were calculated.

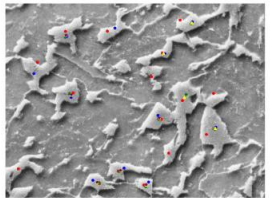


Fig. 4 Example visualization of POIs marked by the expert annotators. Red, green, and blue colored points are the POIs provided by annotators. Yellow points mark a POI that was agreed by two annotators. Purple colored points denote the agreement of three annotators.

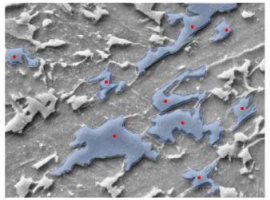
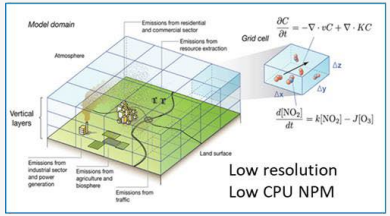
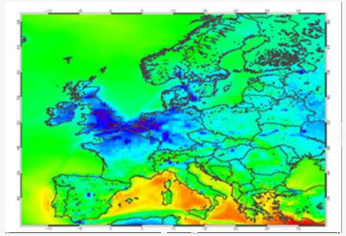


Fig. 5 Segments that are drawn by an expert. The red dots mark the agreed-upon POIs that were collected in the POI annotation step.

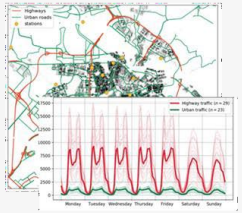
DL4EO: Accelerating Knowledge on Air Quality at street level

In Europe, air pollution causes over 400.000 premature deaths per year and cost on average €1,276 per resident per year, with the largest exposures occurring in cities. Unfortunately, information at the local scale to evaluate the effectiveness of mitigation and monitoring strategies is scarce.

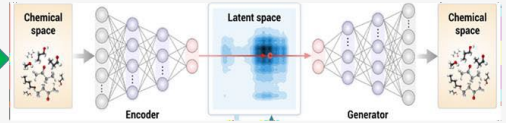




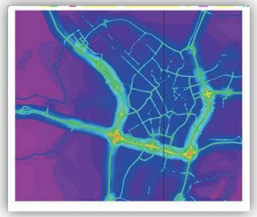
High Resolution
High CPU dispersion model



High Resolution Proxy data



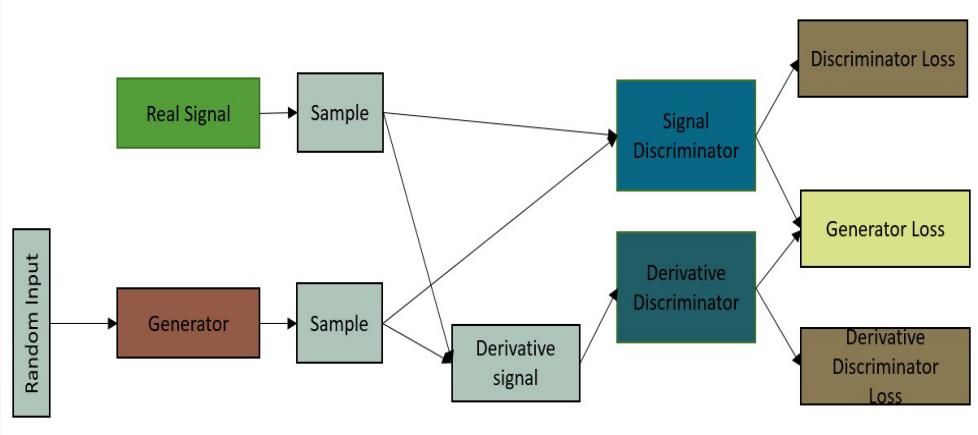
High Speed and Low CPU DL approach

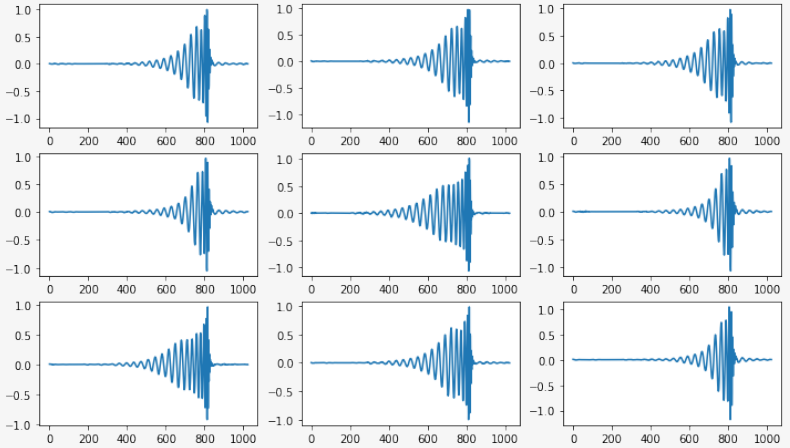


DOWNSCALING

- Investigating the benefit of Deep Learning breakthroughs to assess urban air quality

Einstein Telescope Project: Data Augmentation by Generating Black Hole Merger Events With Deep Neural Networks





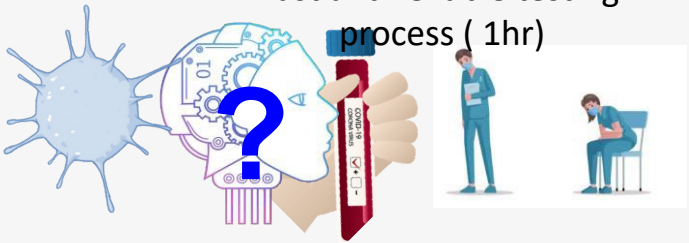
Healthcare

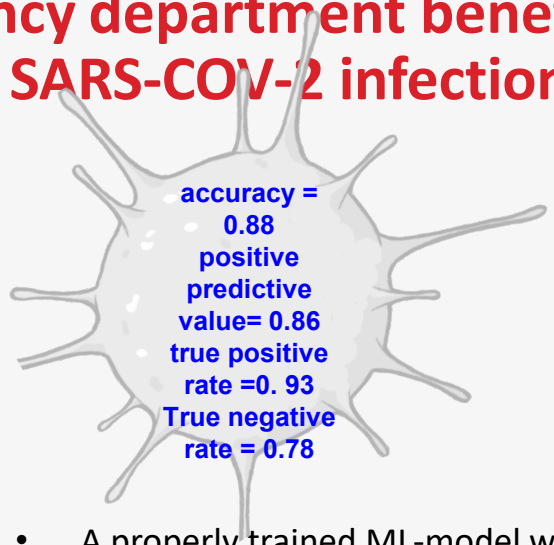
Dr. Lyana Curier

ML4Health : Can an emergency department benefit from Machine Learning to detect SARS-COV-2 infection?

CURRENT
testing is a slow-moving process (4- 12 hr)

WANTED
fast and reliable testing process (1hr)





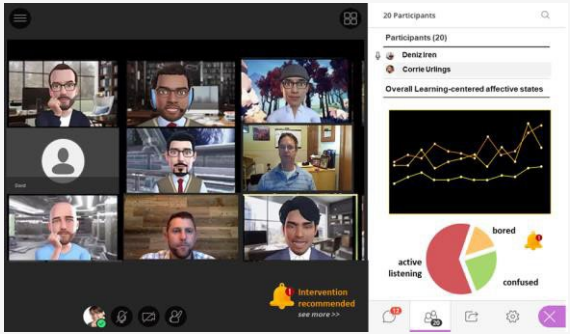
- A properly trained ML-model was able to correctly predict COVID- 19 infection using using 14 hemocytometric parameters within 1 hour
- A novel approach to reduce time spent by patients awaiting results in isolation ward and mitigate the burden on the healthcare system
- Correctly deployed and embedded in the day to day practice of ED, this model will be a useful tool as SARS-CoV-2 is likely to become seasonal

EdTech

Dr. Deniz Iren

Affective Computing Research Line at CAROU

Sense the Classroom



How to assist teachers to sense the overall affective state of the students in and online classroom?

Shingjergi, K., Iren, D., Urlings, C. C. J., & Klemke, R. (2021, January). Sense the classroom: AI-supported synchronous online education for a resilient new normal. In *ECTEL 2021*.

Facegame

How can we train individuals perceive and mimic emotional facial expressions better?

In review

Mood Cloud

Can the tangible everyday objects be used to help humans convey and perceive moods and emotions of themselves and others?

Overdijk, R., Iren, D., & Karahanoglu, A. (2022). Investigating the Design Opportunities for Mood Self-Tracking and Regulating. In *DRS 2022*.

How to get in touch with us, how to work with us

- We are also involved with regular education in OUNL
  - In the MsC of Informatica, I lead the Deep Neural Engineering course (starting in Feb 2023)
  - Dr Deniz Iren is leading the Data Analytics course in Information Sciences
  - Dr Alex Henkel is involved with the management department courses
  - Dr Lyana Curier is going to be involved with econometrics in the Management department

- But, we also often hire students as research assistants:
  - If you are a technical oriented student looking for a first experience in AI and you are looking for a job, remember to send an email to carou@ou.nl !

That’s all, Folks!

Any questions?