umcg Oncologie
Comprehensive Cancer Center

Betrokkenheid van laboranten in ML modellen en ML planning

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Disclosures

	COI status	Names of companies / organizations
① Post of executive / consultant	No	
② Stocks	No	
③ Patent royalties	No	
④ Stage moneys	No	
⑤ Manuscript fees	No	
⑥ Grant / Research funding	YES	Department of Radiation Oncology has research collaborations with IBA, RaySearch Laboratories, Siemens, Mirada Medical and VisionRT
⑦ Other rewards	No	

Mijn weg

MBRT

RT Zwolle

NG Hoogeveen

RT Groningen

RT Gjøvik

RT Groningen

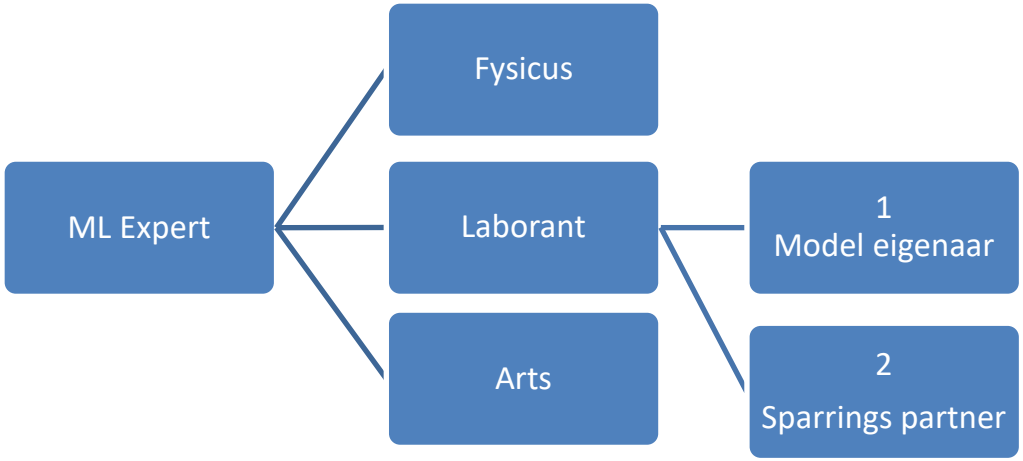
Machine Learning Protonen Planning

Doel:

- Kwaliteit
- Tijd efficiëntie

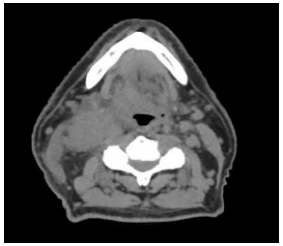
Machine Learning Expert / Werk Groep

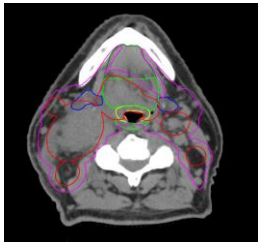
- Een werkgroep per ML model:

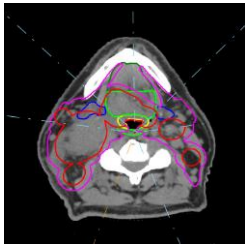


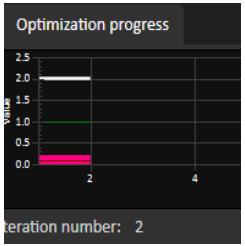
Planning Workflow

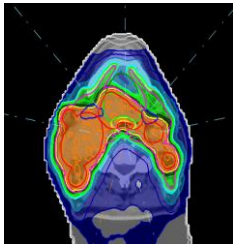
Image → Contour → Beams → Optimize → Dose



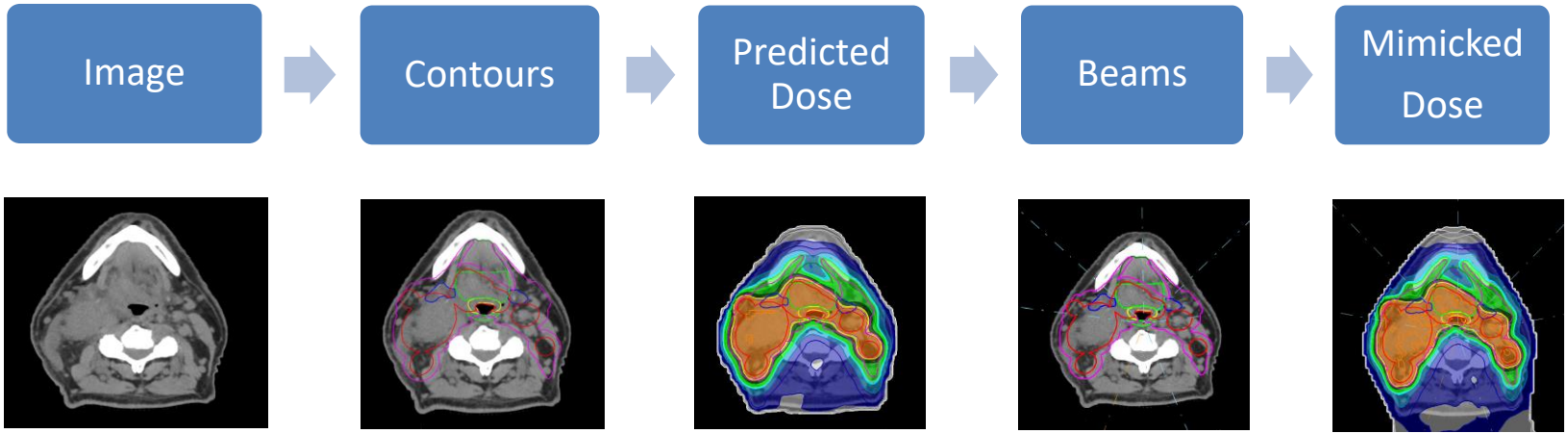








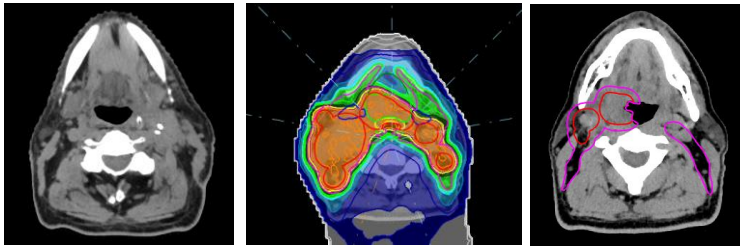
Machine Learning Workflow

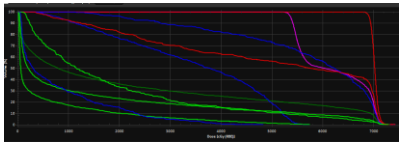


RSL-D-RS-11B-MLREF-EN-1.0-2021-12-10 RAYSTATION 11B MACHINE LEARNING REFERENCE MANUAL
RSL-D-RS-11B-SEML-EN-1.0-2021-12-10 RAYSTATION 11B SCRIPTING ENVIRONMENTS FOR MACHINE LEARNING

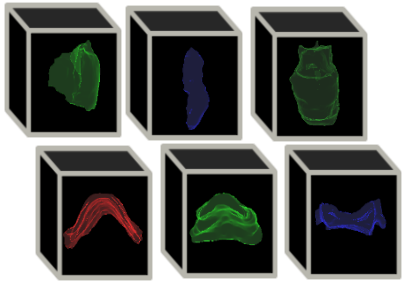
Machine Learning Model Data Selectie

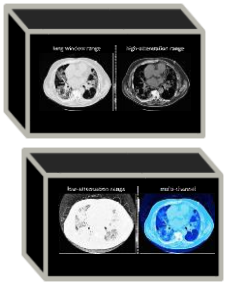
- Oropharynx
  - Bilateraal
  - 2 dosislevels (54,25 Gy + 70,00 Gy)
  - Protonen



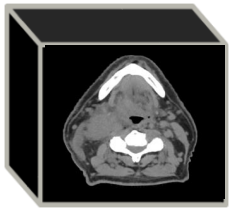


Machine Learning Model Training



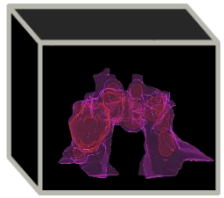


CT

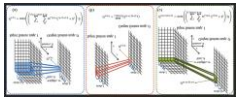


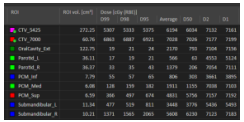
OAR

Target

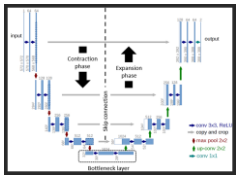


Multichannel Image Volume

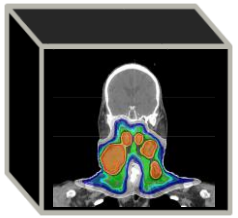




U-NET



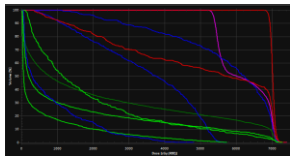
Dose volume

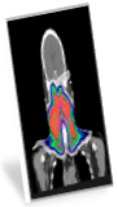


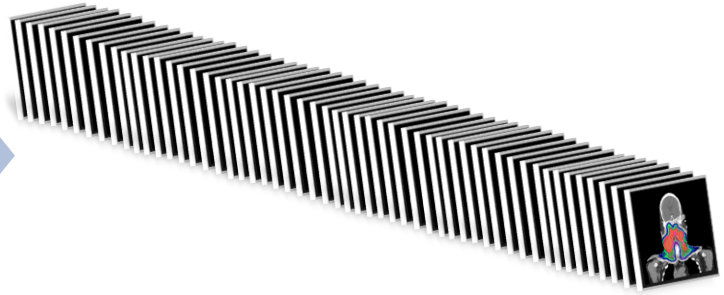
Ronneberger, O., Fischer, P., Brox, T., 2015. U-Net: Convolutional Networks for Biomedical Image Segmentation. / Çiçek, Ö., Abdulkadir, A., Lienkamp, S.S., Brox, T., Ronneberger, O., 2016. 3D U-Net: Learning Dense Volumetric Segmentation from Sparse Annotation. / Punn, N.S., Agarwal, S. Modality specific U-Net variants for biomedical image segmentation: a survey./ H. -C. Shin *et al.*, "Deep Convolutional Neural Networks for Computer-Aided Detection: CNN Architectures, Dataset Characteristics and Transfer Learning," in *IEEE Transactions on Medical Imaging* / RSL-D-RS-11B-MLREF-EN-1.0-2021-12-10 RAYSTATION 11B MACHINE LEARNING REFERENCE MANUAL

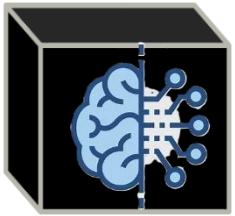
Machine Learning Model Training

DVH → Predicted DVH → Post processing → Clinical goals

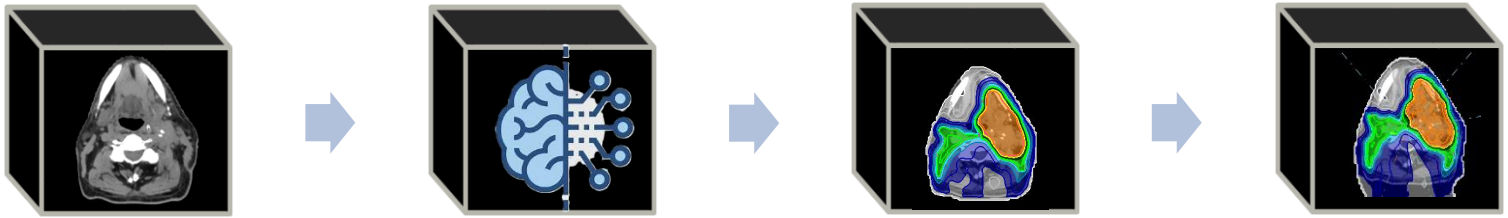








Machine Learning Model



Settings Nieuw Model → Predict Settings → Mimic Settings

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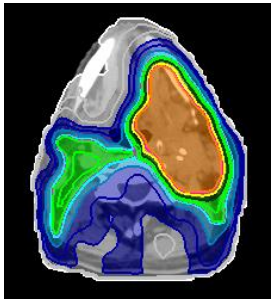
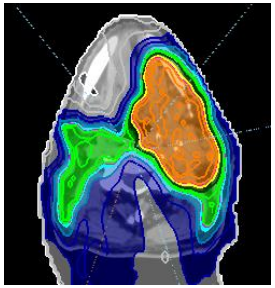
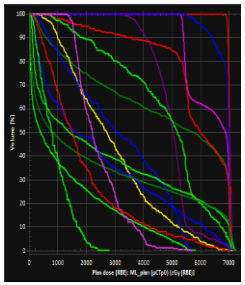
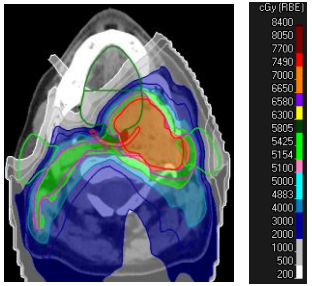
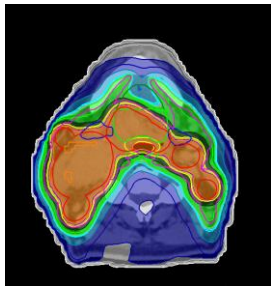
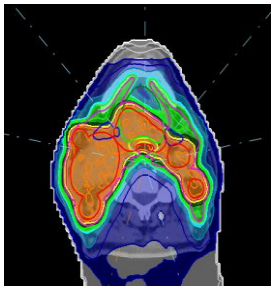
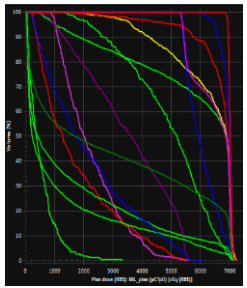
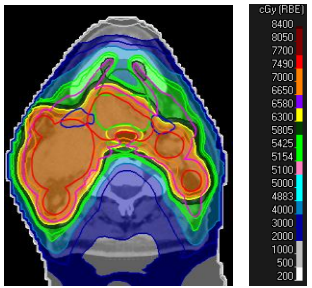
RSL-D-RS-11B-SEML-EN-1.0-2021-12-10 RAYSTATION 11B SCRIPTING ENVIRONMENTS FOR MACHINE LEARNING

Machine Learning model Evaluatie

Evaluatie Predictie → Evaluatie Mimicking → Goals → DVH → Robuust

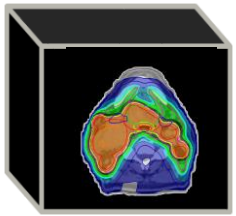



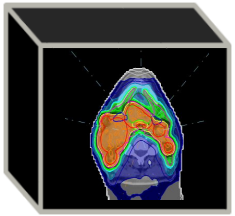





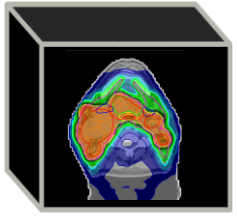



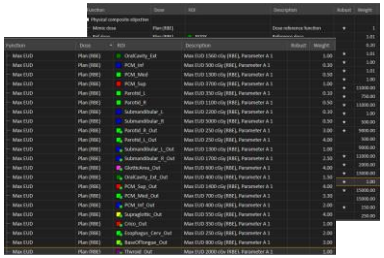
Machine Learning Post Processing

Optimalisatie



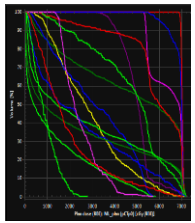




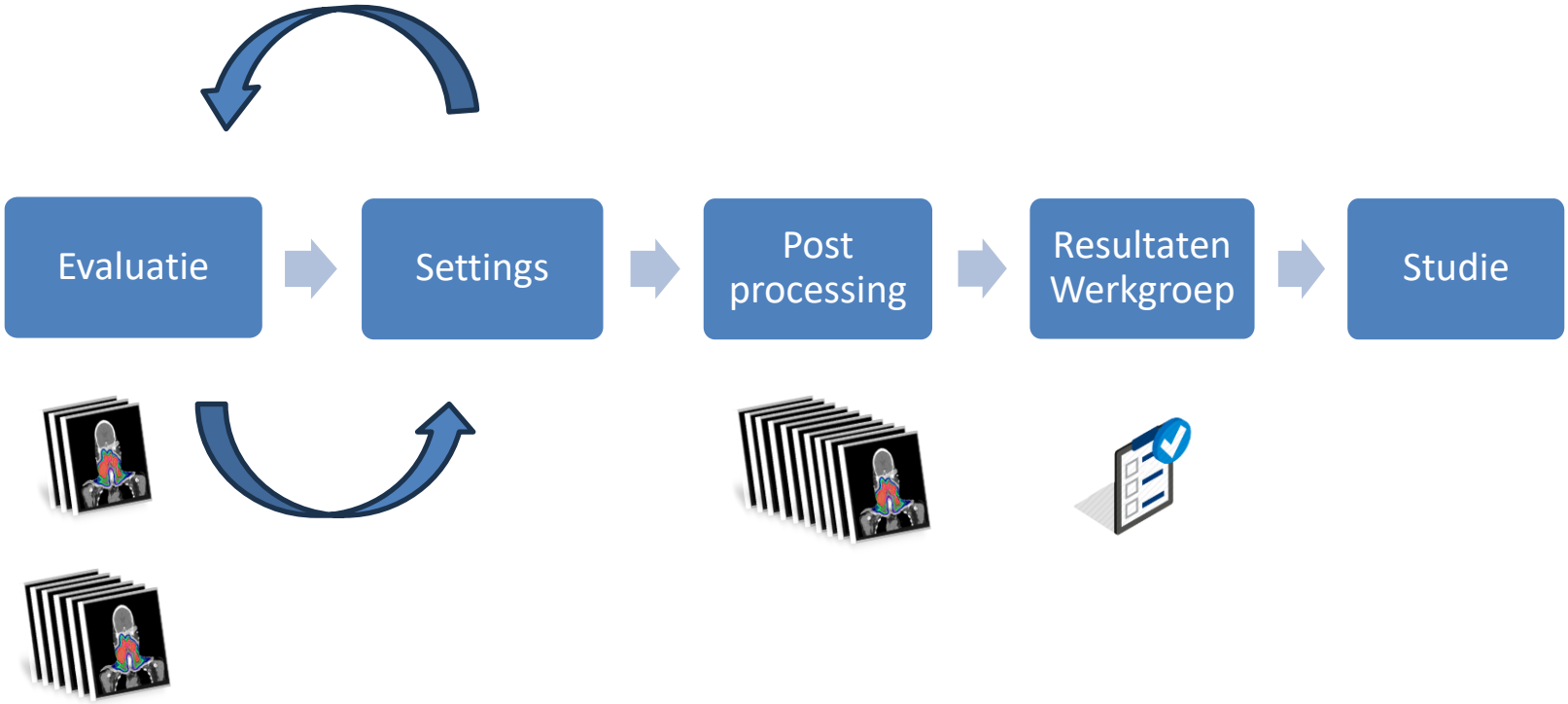


Objectives

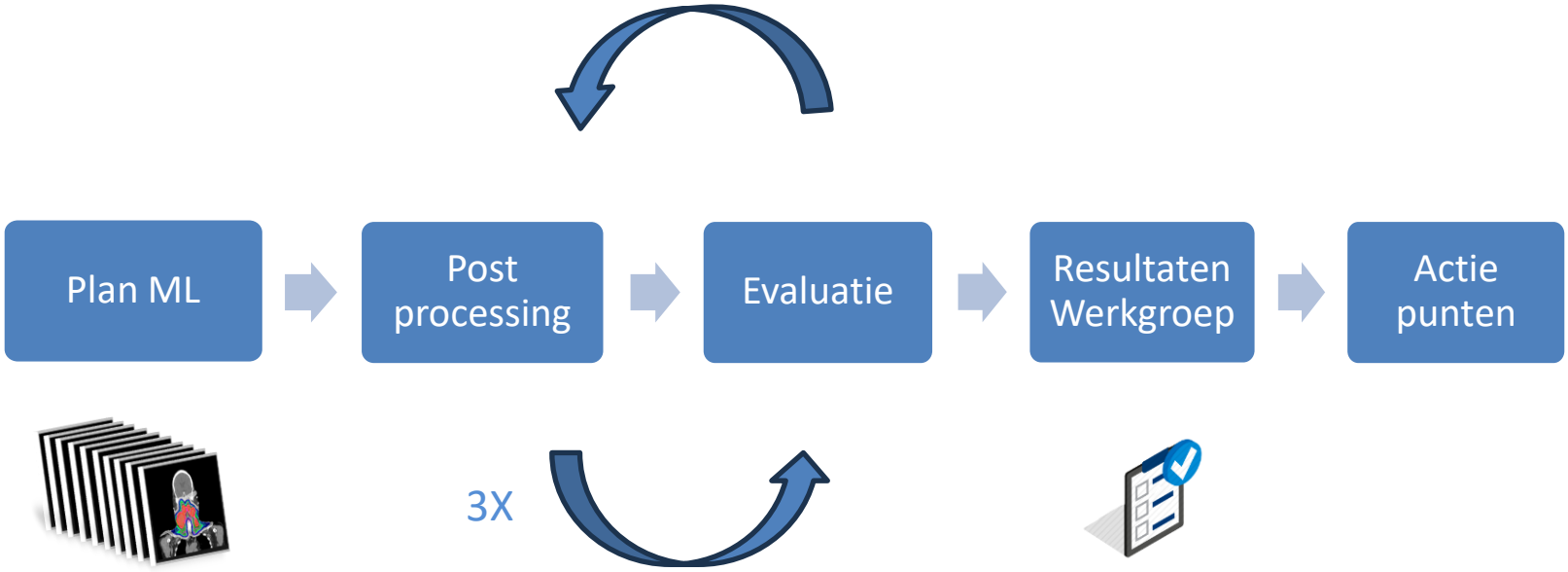
Evaluatie



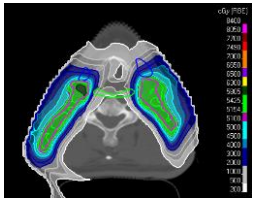
Rol RTT Model Evaluatie

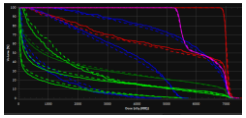


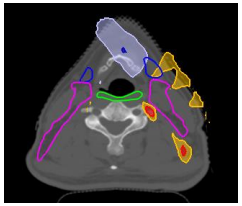
Rol RTT Studie



Rol RTT Studie



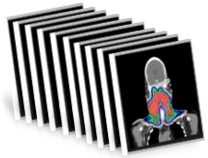


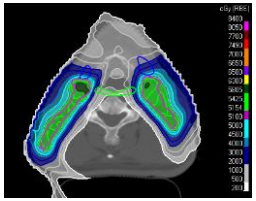


Studie ML

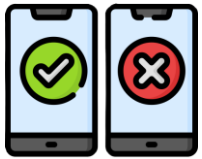
ML

HM





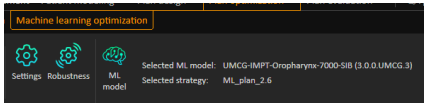
Resultaten



Beste plan

Actie punten

Rol RTT Klinisch



Klinisch → Bundel opzet → ML plan → Post processing → Evaluatie

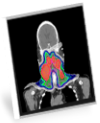
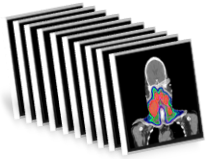
Geschikt ML? → Bundel opzet

Problemen ML? → ML plan

3X

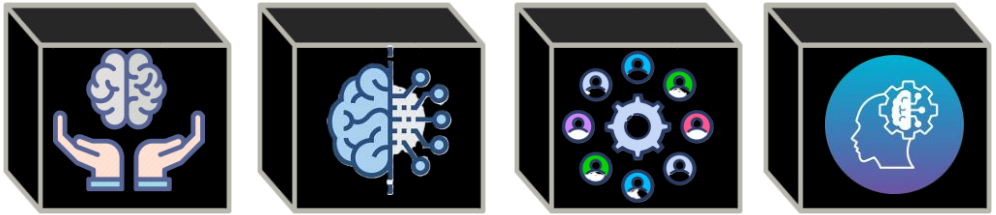
Rol RTT Model Verbetering

Evaluatie ML → Evaluatie HM → Evaluatie RTT → Resultaten Werkgroep → Model updaten

Leercurve

- Kennis
  - Machine Learning
  - Data Selectie
  - Collega's
  - Modellen



Leercurve

- Kwaliteit
  - Behoud
  - Verbetering
  - Concurrentie
  - Controle

Leercurve

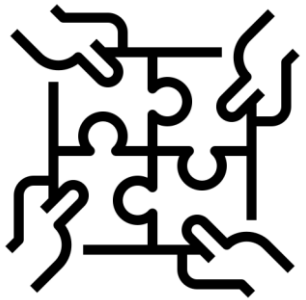
- Tijd
  - Besparing?
  - Extra investering?

Leercurve

- Ontwikkeling
  - Planningstechniek
  - Software
  - Regelgeving

Conclusie

- Betrokkenheid van laboranten in ML modellen is zeker wenselijk vanaf een vroeg stadium in het proces.
- Betrokkenheid van laboranten in ML planning is noodzakelijk vanwege de invloed van Machine Learning op de rol en functie van de laborant.



Bedankt voor je aandacht!

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