

RP5 - Analysis of preclinical image data including further clinical data

Research question:

” Can deep learning techniques be used to teach a model for predicting clinical endpoints from photographs or histological images of the primary tumor alone or from a combination of the two?”

Preclinical image data source: primary melanomas

- Photos or dermatoscopic images
- histopathological slices
- not consistently digitized and stored in the PACS

Data treasure:

- More than 100,000 unframed photos of all relevant findings of the past 27 years
- Link with patient names and diagnosis
- Digitization current status: approx. 2,600 slides
- Digitization of histopathological images planned

Clinical endpoints:

- 5-year survival rate,
- Recurrence probability
- Therapy options and response

Solution approach:

Deep Learning , CNN Modelle, Transfer learning, Data augmentation [1], [2]

- e.g. LeNet, AlexNet , VGG , GoogLeNet, DenseNet, ResNet [3]

Hyper parameters

Convergence: Gradient descent Variants (Batch, Stochastics, Mini-batch), learning rate, decay factor, mini-batch size, number of epochs, Optimization (Momentum, Nesterov accelerated gradient), ...

Regularization techniques: early stopping , drop out,...

Automatic classification to use the unlabeled photos for training purposes:

- Photos are both of primary melanomas, as well as e.g. metastases, other skin tumours or skin changes under a system therapy

Validation e.g. at 5-year survival probability by indirect comparison with the TNM classification

State of the art:

2019 - Robinson et al. [4]

- Melanoma of the skin: Histopathological H&E images
- 5-year probability of survival
- CNN, RNN (Convolutional, Recurrent Neural Network)

2019 - Hekler et al. [5]

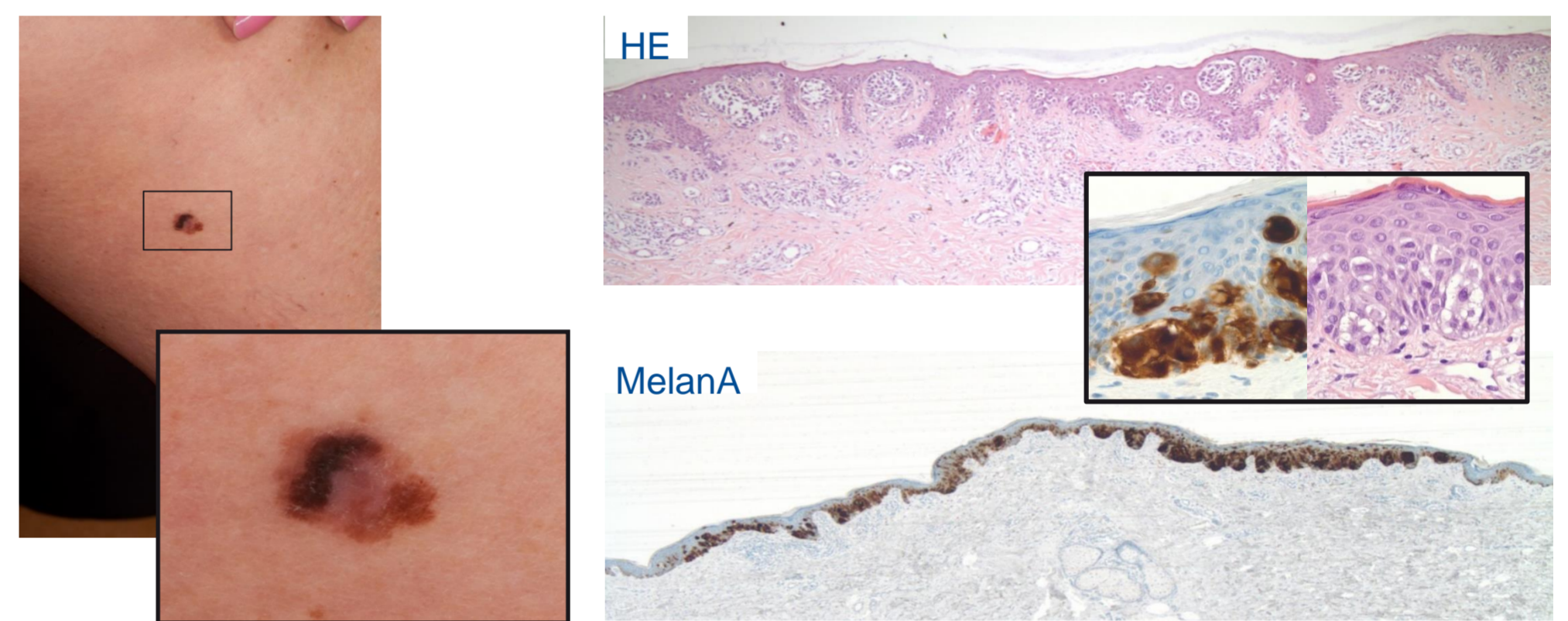
- Melanoma of the skin: Histopathological H&E images
- Diagnosis and classification

2018 - Bychkov et al. [6]

- Colorectal carcinoma: Histopathological H&E images
- 5-year probability of survival

2017 - Esteva et al. [7]

- Melanomas of the skin: photos of primary tumors
- Diagnosis and classification
- Results confirmed several times [8]

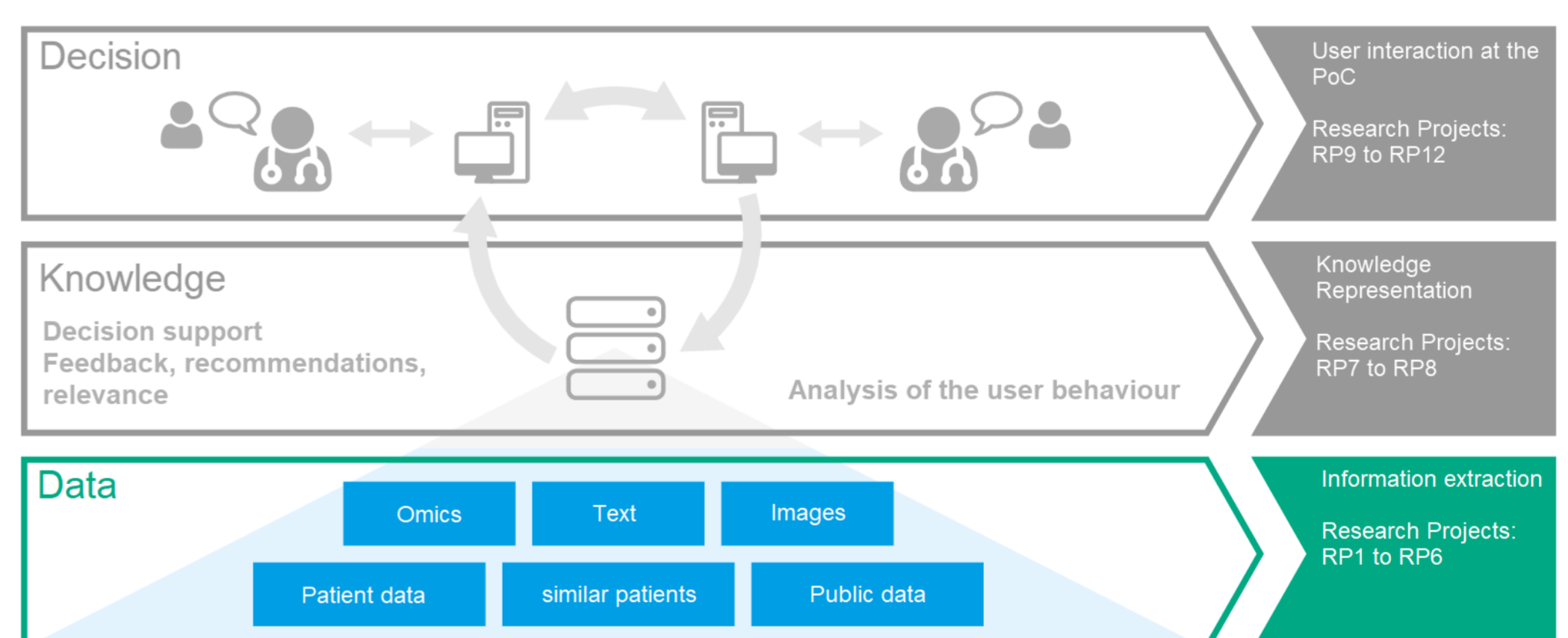


Integration:

Access to the image data is via a SHIP app and a pseudonymized *FHIR* interface

Smart Hospital Learning Factory

Hardware: CPU Cluster, GPU Cluster, TensorRT Server



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