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SIOPEN R-NET

PRIMAGE - AN ARTIFICIAL INTELLIGENCE-BASED CLINICAL DECISION SUPPORT SYSTEM FOR OPTIMIZED CANCER DIAGNOSIS AND RISK ASSESSMENT - A PROGRESS UPDATE

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PRIMAGE
Medical imaging
Artificial intelligence
Childhood cancer research

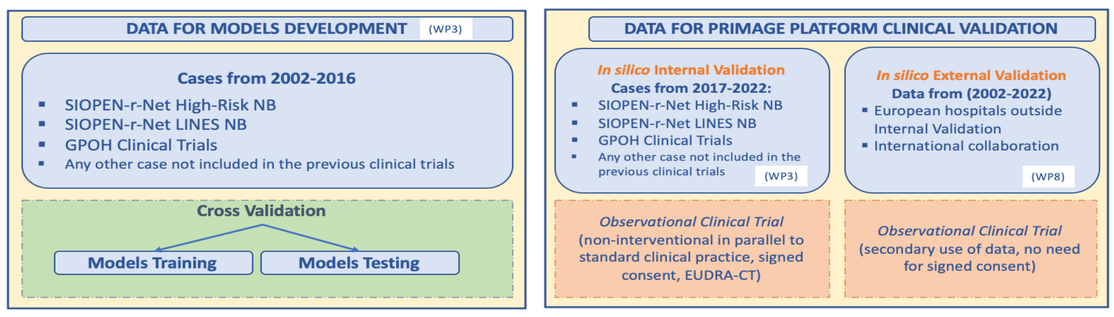
THE FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION
HORIZON 2020

Background and aims

- Patients with neuroblastoma (NB) and diffuse intrinsic pontine glioma (DIPG) suffer from relapse and death, partly due to insufficient knowledge of tumour properties and the lack of tools to integrate this knowledge into clinical decision-making.
- Children with NB and DIPG are enrolled in European clinical trials with standardized acquisition of patient-related imaging and molecular diagnostics, treatment and outcome data.
- These tumour types represent ideal use cases for the development of new integrated artificial intelligence (AI) models for medical imaging-based diagnosis and optimized initial individual risk assessment.
- PRIMAGE´s goal is the development and validation of the methodology and a platform to support decision making in the management of NB and DIPG.

Methods

- Patients enrolled in SIOPEN (LINES, HR-NBL1) and GPOH (NB97, NB2004, NB2004-HR, NB2016-Registry) neuroblastoma trials were included. Imaging studies (MRI, CT, PET, mIBG) obtained at time of diagnosis and at first follow-up after initial treatment were collected from local centers and analyzed using machine/deep learning methods.



PRIMAGE data sources for development of predictive tools at diagnosis of NB

Hospital / Clinical Trial	Data Owner / Provider	Disease Data provided	Clinical Trial ID
Hospital La Fe	HULAFE	NB & DIPG	N/A
HR-NBL1.8 / SIOPEN	CCRI	High Risk NB	NCT01704716
LINES / SIOPEN	HULAFE	Low and Intermediate NB	NCT01728155
GPOH Clinical Trials	UKOELN	NB	Trial NB97 (NCT00017225) Trial NB2004 (NCT00410631) Trial NB 2004-HR(NCT3042429) NB2016 Registry
Pisa University Hospital	UNIPI	NB	N/A

*"NB" includes: low, intermediate and high-risk

- Clinical data and molecular biomarker, e.g. *MYCN* amplification status, are provided through centralized databases (SIOPEN-R-NET) or patient-by-patient including manual curation to ensure quality controlled datasets.

Results

- A PRIMAGE repository was built with imaging, molecular and clinical data. Clinical and molecular variables and corresponding e-forms were defined in line with existing trial databases. Amongst others, data was collected from approximately 50 SIOPEN centers in around 10 countries and pseudonymised using the European Patient Identifer (EUPID) service.

- At the end of September 2022 there are 776 NB cases uploaded in the PRIMAGE platform and 2053 NB imaging studies.

		Diagnosis				After first treatment			
		Total	CT	MR	MIBG	Total	CT	MR	MIBG
NB	Internal	696	360	455	303	581	269	335	183
	External	69	47	34	27	56	28	29	7

Total number of NB imaging studies in the PRIMAGE platform at the end of September 2022

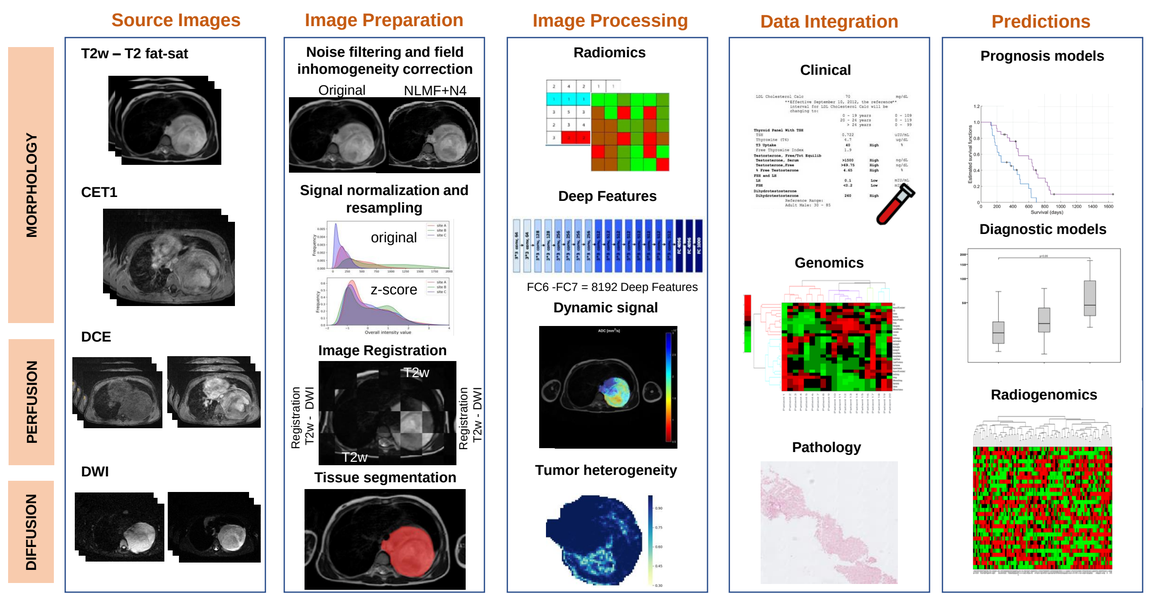
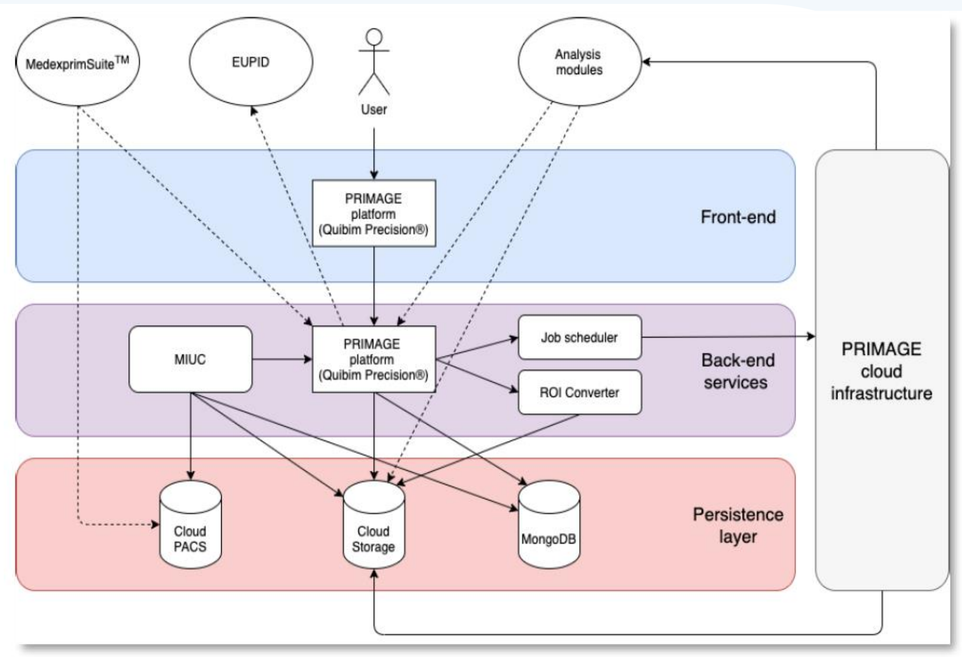


Image processing flowchart in patients with NB



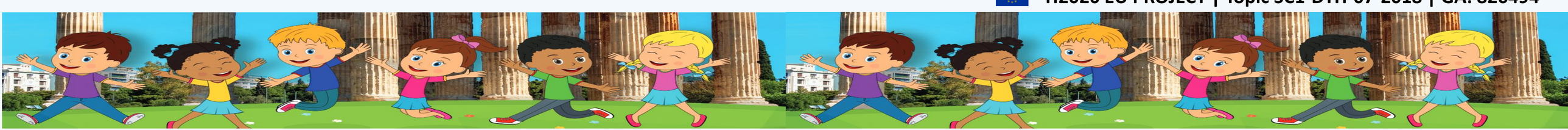
PRIMAGE architecture diagram

- A software infrastructure for data management and radiomics analysis was established enabling quality assessment of images, segmentation and radiomics feature extraction.

- An integrated visual analytics system allows for the interactive visual exploration of radiomics results and integration of various datatypes as well as models predicting clinical endpoints. A pilot version demonstrates feasibility, highlighting the potential of the PRIMAGE platform, but requires further refinements and integration of additional datasets to exploit its full potential.

Conclusions

PRIMAGE platform will support medical image processing and will assess imaging-derived biomarkers in the context of molecular and clinical variables, which is expected to guide diagnosis and individual risk assessment of patients with NB and DIPG in the future.

https://www.primageproject.eu/ PRIMAGE Project @primage_project

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