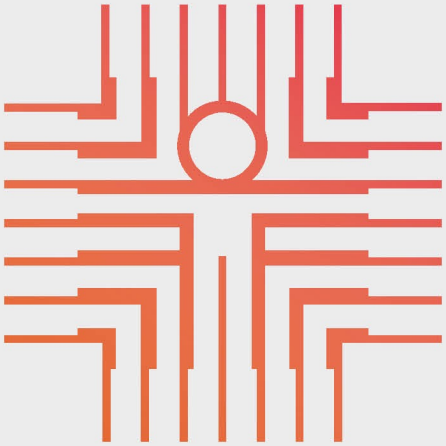
Decision Support for Clinical Neuroimaging



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- Decision support tools (CDS)
- Quantitative imaging tools (CQI)
- Computer aided detection (CADe)
- Computer aided diagnosis (CADx)

- Decision support tools (CDS) — **Alert**
- Quantitative imaging tools (CQI) — **Measure**
- Computer aided detection (CADe) — **Find**
- Computer aided diagnosis (CADx) — **Complement**

Translate a medical problem…

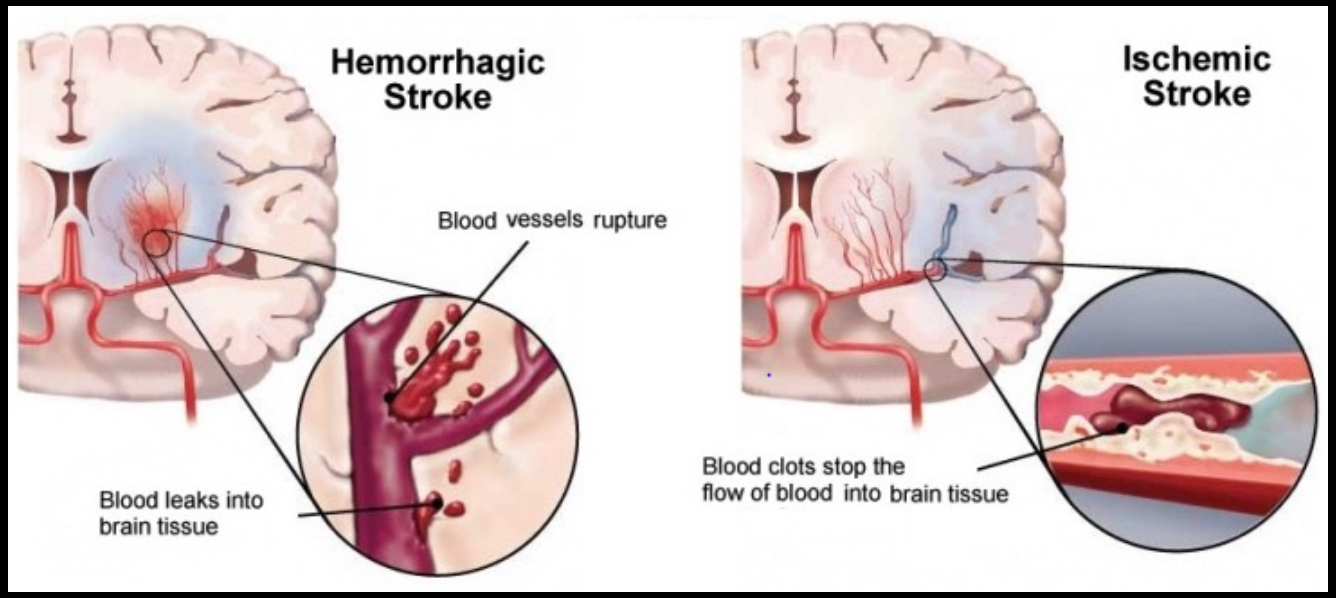
Life threatening emergency

3rd most frequent cause of death

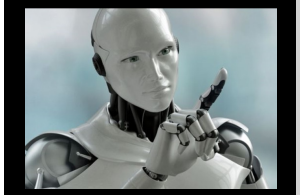
16.000 strokes/y (CH)

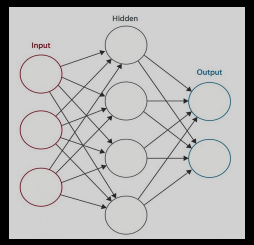
1.9 million neurons every minute

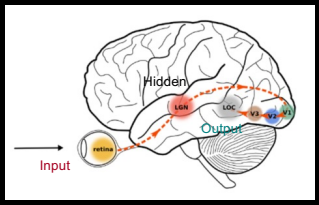
Time-dependent therapy



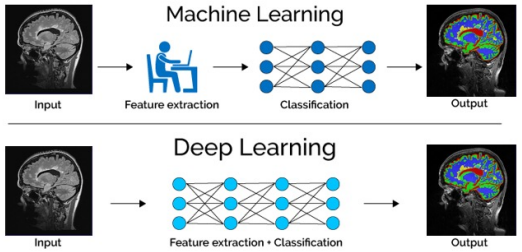
…into computer science



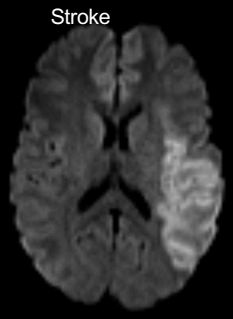


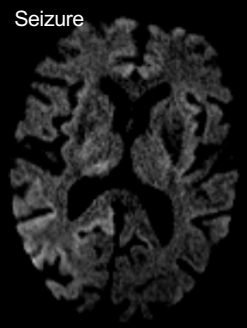


Preprocessing

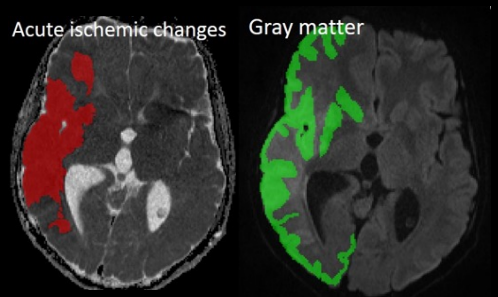


Representation





Classification



Segmentation

Decoding

Weighting

Matching

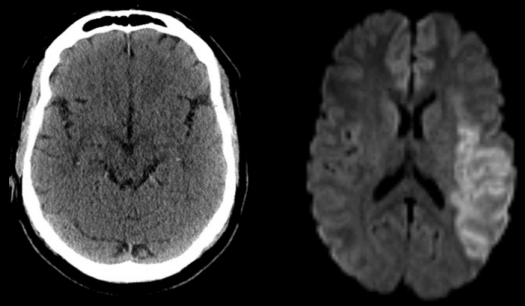
Meaning

Use case for CDS: Ischemic stroke

Diagnostic markers

biological plausibility
performance

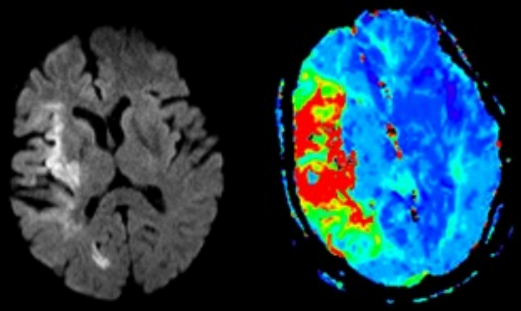
Identification of the ischemic core: ASPECTS



Prognostic markers

response to therapy
guidance

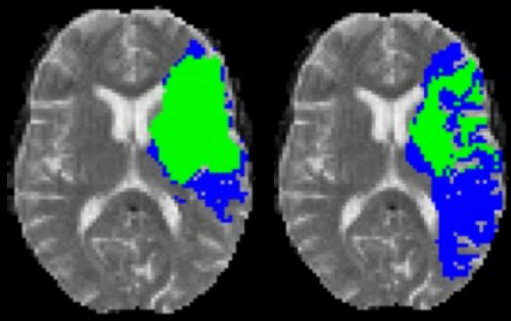
Approximation of tissue at risk: Mismatch



Predictive markers

individual fingerprints
featurization

Identification of non-uniform predictors



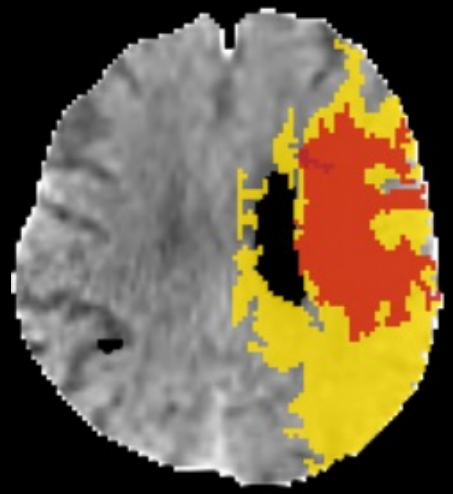
*Chalela JA et al. Lancet 2007; 369 (9558): 293-8
**Campbell BCV et al. N Engl J Med 2015; 372:1009–18

**Saver et al. N Engl J Med 2015;372:2285–95
***Kidwell et al. N Engl J Med 2013;368:914–23.

Methods

Plain CT

CT Angiography



CT Perfusion

Image courtesy: OLEA Medical, with permission

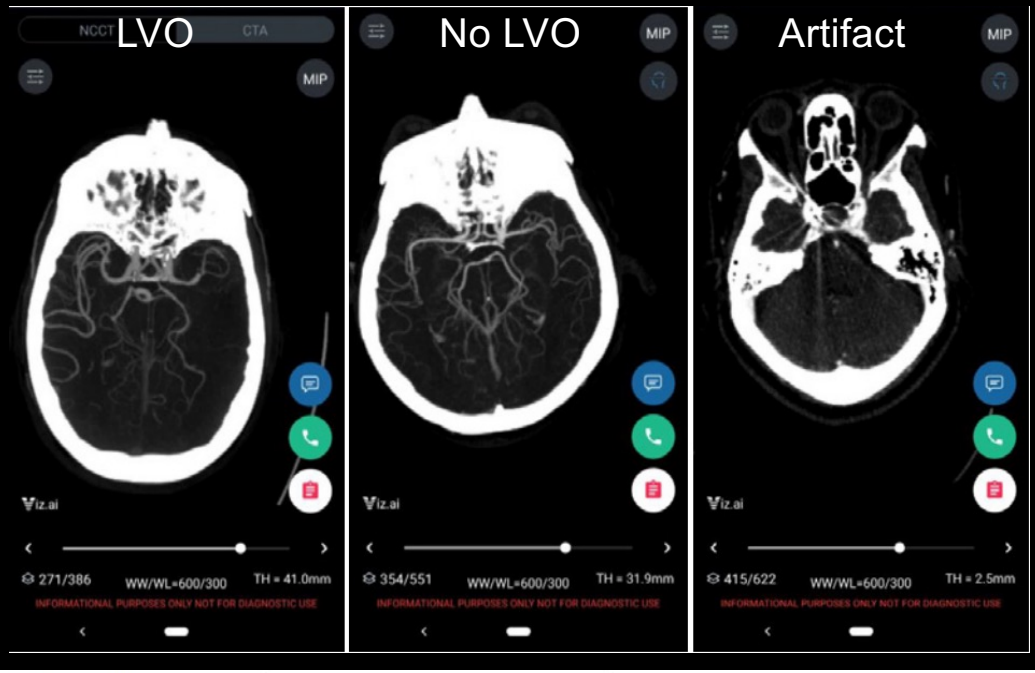
Clinical application

2544 patients

139 hospitals

50% non-specialist centers

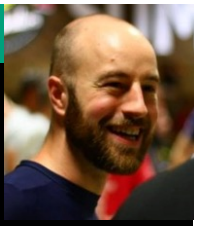
Large vessel occlusion

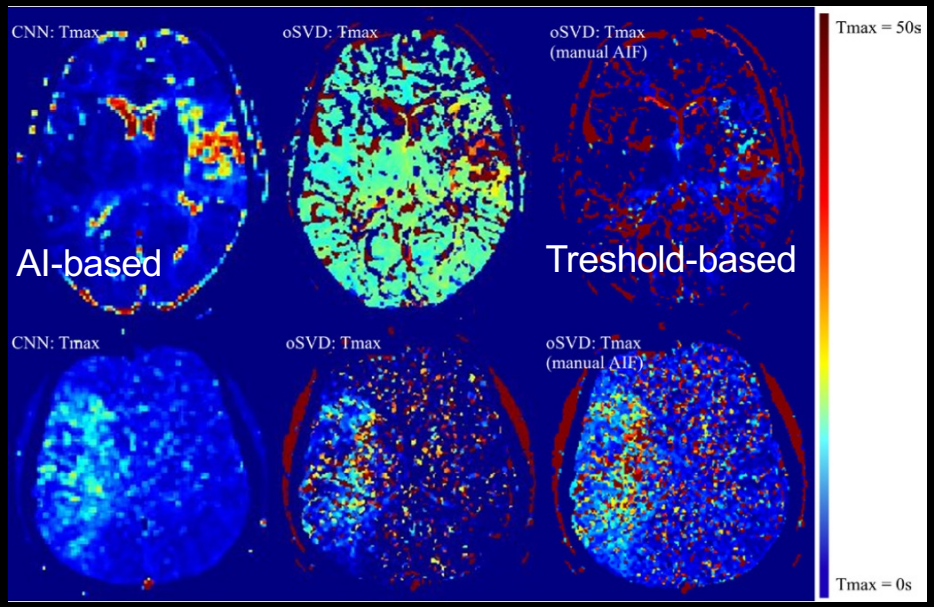


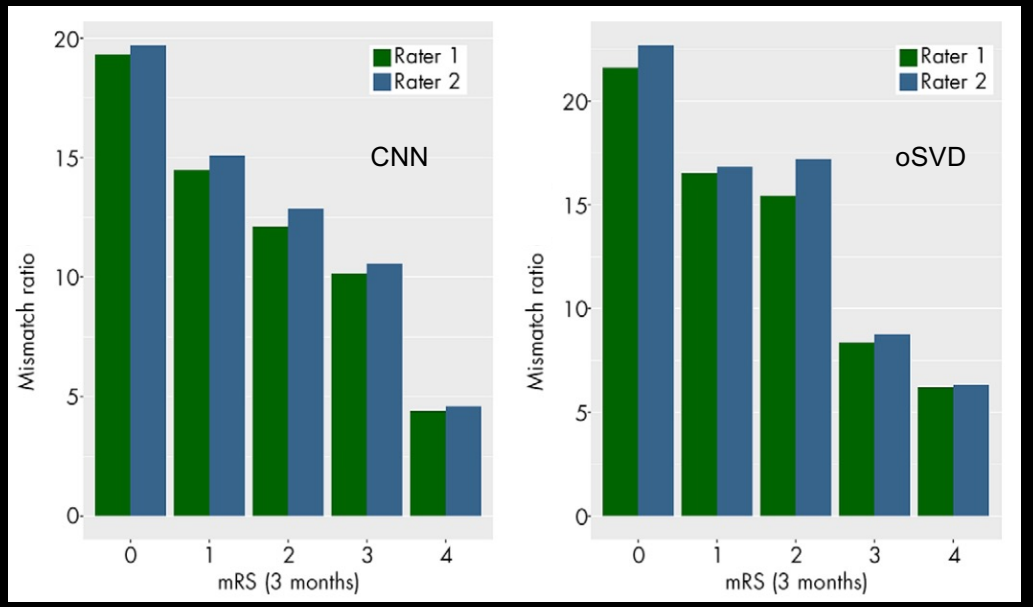
Device performance		
	Sensitivity	96.32% [0.9268, 0.9884]
	Specificity	93.83% [0.9283, 0.9475]
	Time-to-notification	Median = 5 minutes and 45 seconds

"…enables prompt review by stroke specialists…"

AI optimized image quality of raw MRI data

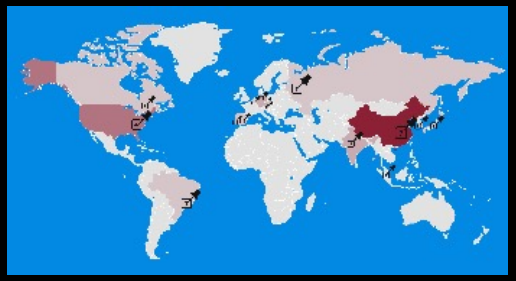




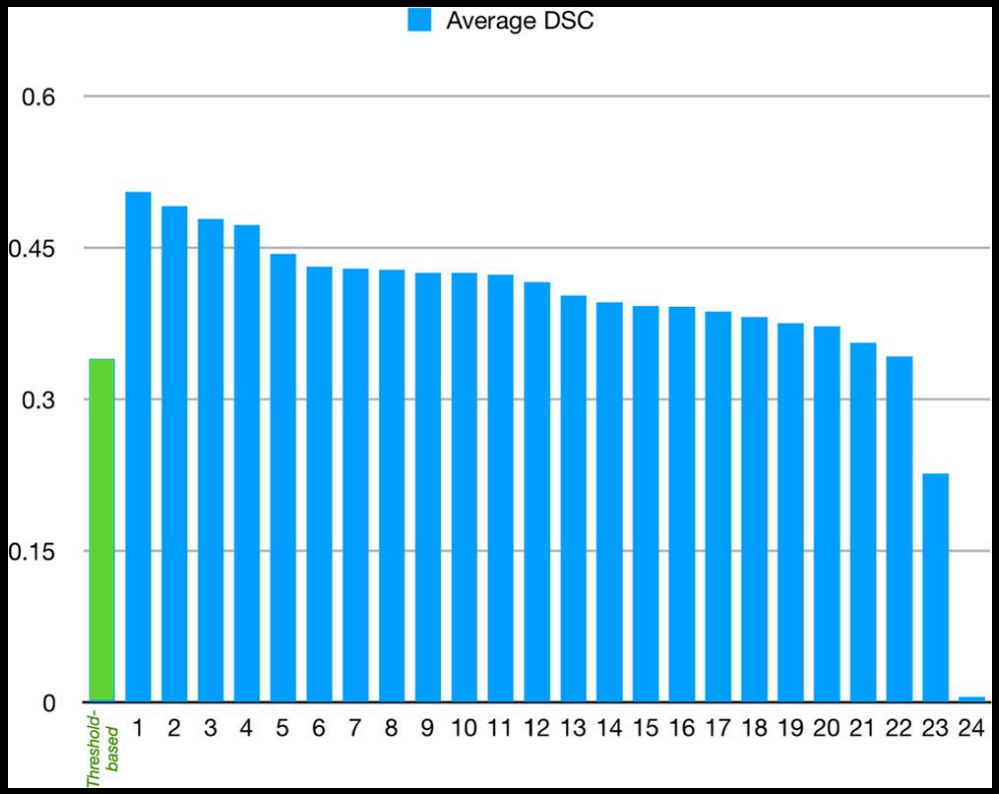


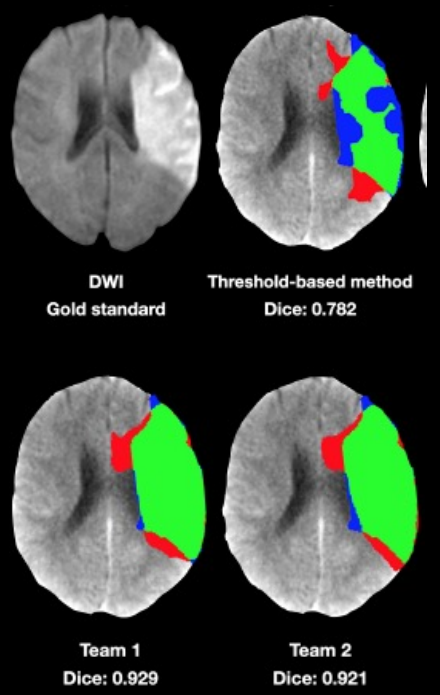
Eligibility Criteria for DEFUSE 3	Rater 1	Rater 2
Satisfied (CNN)	35	35
Satisfied (oSVD)	38	40
Disagreements (CNN vs oSVD)	5	5

AI outperforms fixed tresholds: The ISLES challenge

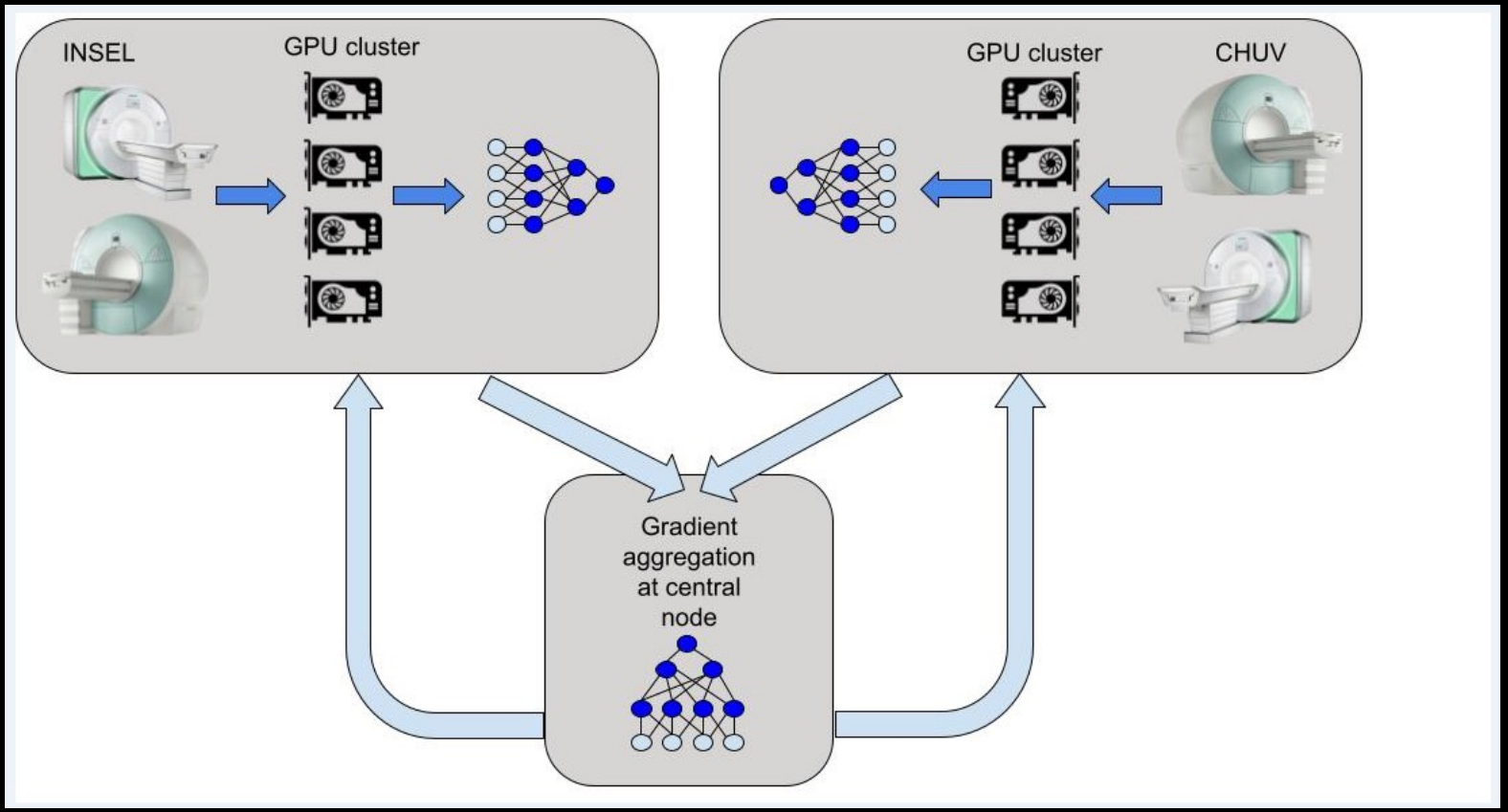


103 stroke pCT scans, 4 centers
DWI poststroke as reference
(mean delay 36 minutes, IQR 25–79)





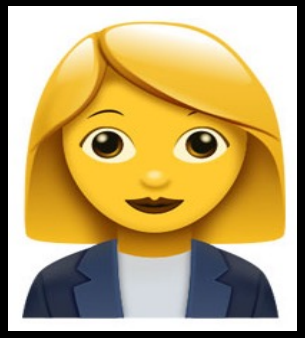
Data diversity : Federated learning



Innosuisse project advanced stroke analytics platform
Siemens Research, Bern & Lausanne University Hospitals

Diploma of Advanced Studies

R & D



MedTec

Deployment

MAS/DAS Artificial Intelligence Techniques for Diagnostic Medical Systems

covers the necessary skills of analyzing a diagnostic problem and develop a solution with artificial intelligence

MAS/DAS Artificial Intelligence in Diagnostic Medical Systems

builds the bridge between development and integration

MAS/DAS Artificial Intelligence Translational Diagnostic Medical Systems

strong emphasis on the integration and deployment into a clinical workflow for patient care

AI impacts on Medical Imaging


Raphael Meier PhD


Richard McKinley PhD

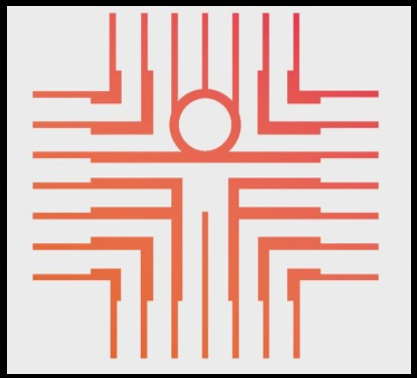

PD Franca Wagner M.D.


Michael Rebsamen M.Sc.


Arsany Hakim M.D.


Johannes Kaesmacher M.D./PhD

ISLES 2018: Prof. Mauricio Reyes PhD / Prof. Greg Zaharchuk MD, PhD (UC Stanford)



Nature 2015; 525: 305