

Deep Learning e calcolo ad alte prestazioni per l'elaborazione di immagini biomediche

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UNIVERSITÀ
DEGLI STUDI
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UNIMORE
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MODENA E REGGIO EMILIA



DeepHealth

Deep-Learning and HPC to Boost Biomedical Applications for Health



- Facilitate the daily work and increase the productivity of medical personnel and IT professionals in terms of **image processing** and the use and **training of predictive models** without the need of combining numerous tools.
- Offer a unified framework adapted to exploit underlying heterogeneous **HPC and Big Data** architectures supporting **state-of-the-art and next-generation Deep Learning (AI) and Computer Vision** algorithms to enhance European-based medical software platforms.
- Put **HPC computing power** at the service of biomedical applications with DL needs and, through an interdisciplinary approach, **apply DL techniques on large and complex image biomedical datasets** to support new and more efficient ways of diagnosis, monitoring and treatment of diseases.

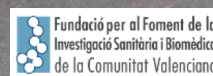


Duration: 36 months

Starting date: Jan 2019



21 partners from **9 countries:** Research centers, Health organizations, large industries and SMEs



DeepHealth at a glance




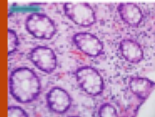
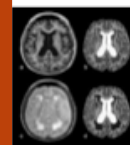
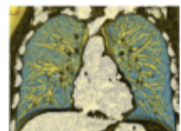

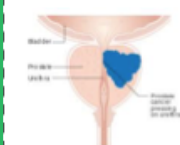


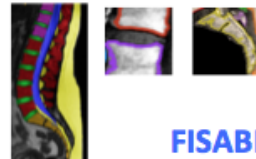





Our involvement

UNITO


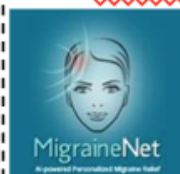





SALU

CRS4

Use cases and data sets

<p>UC1: migraine and seizure prediction</p>  <p>WINGS</p>	<p>UC2: Colon pathology</p>  <p>UNITO</p>	<p>UC3: Brain scans</p>  <p>UNITO</p>	<p>UC4: Chest scans</p>  <p>SALU</p>	<p>UC5: Deep Image annotation</p>  <p>UNITO</p>	<p>UC6: Prostate tumour diagnosis</p>  <p>KAROL CRS4</p>	<p>UC7: Depression</p>  <p>OVGU MAGD</p>
<p>UC8: Dementia</p>  <p>OVGU MAGD</p>	<p>UC9: Lumbar spine</p>  <p>FISABIO</p>	<p>UC10: Alzheimer</p>  <p>FISABIO</p>	<p>UC11: Urology</p>  <p>SIVECO SCTH</p>	<p>UC12: Skin cancer</p>  <p>UNIMORE</p>	<p>UC13: Epileptic seizures</p>  <p>CHUV EPFL</p>	<p>UC14: Neurodegen. disease</p>  <p>CHUV EPFL</p>

platforms

<p>PF1: Open Innovation Platform</p>  <p>PHILIPS</p>	<p>PF2: <u>MigraineNet</u></p>  <p>WINGS</p>	<p>PF3: <u>ExpressIF™</u></p>  <p>CEA</p>	<p>PF4: PIAF</p>  <p>THALES</p>	<p>PF5: Open <u>DeepHealth</u></p>  <p>UNITO</p>	<p>PF6: Digital pathology</p>  <p>CRS4</p>	<p>PF7: Lumen</p>  <p>everis lumen</p> <p>EVERIS</p>
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UniTO contributions



Ital-IA
ITALIA INTELLIGENZA ARTIFICIALE
CINI National Lab AIIS



3 departments, 4 research groups: **Image processing**, **Parallel Programming**, **Anatomical pathology**, **Neuroscience radiology**

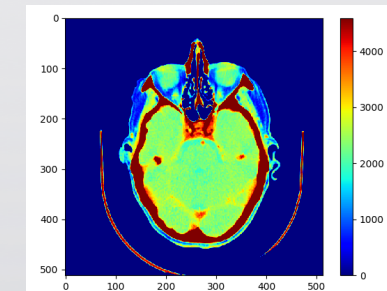
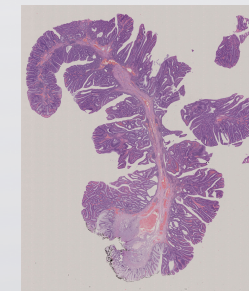


Deep Learning, High Performance Computing, Medical expertise



Use cases

- DL for colorectal polyps diagnosis
- DL for estimation of brain perfusion
- DL for diagnosis generation in natural language

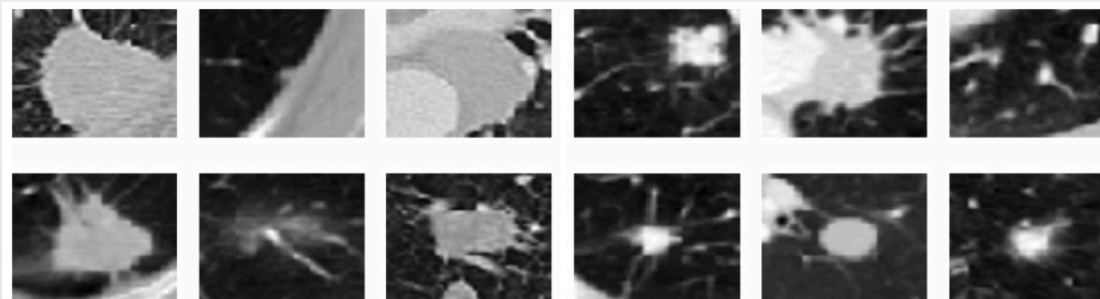


Città della Salute e della Scienza di Torino

- One of the biggest Hospitals in Italy
- Radiology 2 department is equipped with 4 CT scans, performing about 42000 exams/year, 50% of which are patients with oncological diseases.

Pulmonary nodule: small, focal, radiographic opacities that may be solitary or multiple, measuring ≤ 30 mm in diameter. Most of them are BENIGN

→ *Difficult to find, hard to classify, high number of FP findings*



From Shaffie et al., Tech in Cancer Research & Treat, vol. 17: 1-9

- Create a **multidisciplinary team** (doctors, radiographers, computer scientists) to collect anonymized CT scans
- **Classification** and **labelling** of pulmonary nodules and **prediction** of their malignancy

