HELLENIC REPUBLIC
National and Kapodistrian University of Athens
EST. 1837

MSc in Data Science and Information Technologies (DSIT)

dsit.di.uoa.gr

Dept. of Informatics and Telecommunications, NKUA
Athena Research Center
Biomedical Research Foundation of the Academy of Athens

Dimitrios Gunopulos, Director

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MSc in Data Science and Information Technologies (DSIT)

The **DSIT** international **MSc** program is offered in English jointly by

- National and Kapodistrian University of Athens (NKUA)

  Dept. of Informatics and Telecommunications, di.uoa.gr

- **Biomedical Research Foundation of the Academy of Athens (BRFAA)**

  www.bioacademy.gr

- **ATHENA Research Center**

  www.athenarc.gr

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BRFAA
BIOMEDICAL RESEARCH FOUNDATION ACADEMY OF ATHENS

ATHENA

All are top research institutions with world class faculty and great research presence and contributions.

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MSc in Data Science and Information Technologies (DSIT)

Overview

- **DSIT offers two specializations in:**
  1. **Big data and Artificial Intelligence**
  2. **Bioinformatics – Biomedical data science**
- Duration: 3 semesters (18 months, max 36 months)
- Students must complete **10 courses** and a **MSc Thesis**
- Tuition: graduate students pay nine hundred euros (900 €) per semester, for 3 semesters.
- For more information**: dsit.di.uoa.gr** or email dg@di.uoa.gr, eliasm@di.uoa.gr (bioinformatics concentration) kkanavou@di.uoa.gr (administrative assistance)

MSc in Data Science and Information Technologies (DSIT)

Salient characteristics of the program

- DSIT is operating since 2018 and is **one of the most popular international MSc Programs in Greece**
- **Strong interdisciplinary** program on two state-of-the-art specializations:
  1. **Big data and Artificial Intelligence**
  2. **Bioinformatics – Biomedical data science**
- **Small classes and selective:** 20 students selected in each specialization
- Collaboration of three top research institutes offers the students the opportunity to **work on advanced topics** of their choosing
- ~80% of the instructors are NKUA professors or researchers at the Athena RC or the Biomedical Research Foundation (all are PhDs)
- Mandatory **MSc thesis** encourages high quality research engagement by the students

MSc in Data Science and Information Technologies (DSIT)

Application process

- 20 students admitted in each specialization
- **Applications accepted until May 30**
- Results are announced typically in less than 4 weeks
- Proof of competency in English and Bachelor's degree in related field are required
- **All application process information available at: dsit.di.uoa.gr**

1. Big Data and Artificial Intelligence

Α΄ Εξάμηνο

Μαθήματα Υποχρεωτικά	ECTS
Ανάλυση Δεδομένων Υψηλής Κλίμακας - Big Data Analytics	6
Συστήματα βάσεων δεδομένων - Database Systems	6
Τεχνολογίες Γνώσεων - Knowledge Technologies	6
Μηχανική Μάθηση - Machine Learning	6

Β΄ Εξάμηνο

Μαθήματα Υποχρεωτικά	ECTS
Νευρωνικά δίκτυα βάθους - Deep Neural Networks	6
Διαδίκτυο Πραγμάτων - The Internet of Things	6
Διαχείριση Μεγάλων δεδομένων - Big Data Management	6
Ανάλυση και Επεξεργασία Εικόνων - Image Processing and Analysis	6

1. Big Data and Artificial Intelligence

Α΄ Εξάμηνο	
Μαθήματα Επιλογής (επιλέγεται ένα)	**ECTS**
Αλγόριθμοι Ομαδοποίησης - Clustering Algorithms	6
Βιοστατιστική - Biostatistics	6
Επεξεργασία φυσικής γλώσσας - Natural Language Processing	6
Κοινωνικές Προεκτάσεις των Τεχνολογιών Γνώσης και 4η Βιομηχανική Επανάσταση - Social Implications of the Technologies of Knowledge and 4rth Industrial Revolution	6
Ανάλυση χρονικών δεδομένων και εφαρμογές - Time Series Data Analysis and Applications	6
Εισαγωγή στην Βιοπληροφορική - Introduction to Bioinformatics	6
Θεωρία Πληροφορίας - Information Theory	6
Θεωρία και Αλγόριθμοι Βελτιστοποίησης - Optimization - Theory and Algorithms	6
Ειδικά θέματα Μεγάλων Δεδομένων και Τεχνητής Νοημοσύνης - Special Topics in Big Data and Artificial Intelligence	6
Σύνολο (ECTS)	30

1. Big Data and Artificial Intelligence

Β΄ Εξάμηνο	**ECTS**
Μαθήματα Επιλογής (επιλέγεται ένα)	
Ανάλυση Γεωμετρικών δεδομένων - Geometric Data Analysis	6
Εφαρμογές Επιστήμης Δεδομένων και Τεχνολογιών Πληροφορικής στις Νευροεπιστήμες - Application of Data Science and Information Technologies in Neurosciences	6
Εφαρμογές Επιστήμης Δεδομένων και Τεχνολογιών Πληροφορικής στην Ιατρική - Applications of Data Science and Information Technologies in Medicine	6
Καινοτομίες Επιστήμης δεδομένων & Τεχνολογιών Πληροφορικής - Innovations in Data Science and Information Technologies	6
Αλγόριθμοι στη Μοριακή Βιολογία - Algorithms in Molecular Biology	6
Μηχανική Μάθηση στην Υπολογιστική Βιολογία - Machine Learning in Computational Biology	6
Όραση Υπολογιστών - Computer Vision	6
Ειδικά θέματα Μεγάλων Δεδομένων και Τεχνητής Νοημοσύνης - Special Topics in Big Data and Artificial Intelligence	6
Σύνολο (ECTS)	30

2. Bioinformatics – Biomedical Data Science

Α΄ Εξάμηνο	
Μαθήματα Υποχρεωτικά	**ECTS**
Βιολογία- Φυσιολογία - Biology -Physiology	6
Εισαγωγή στην Βιοπληροφορική - Introduction to Bioinformatics	6
Εισαγωγή στη Βιοτεχνολογία - Introduction to Biotechnology	6
Μηχανική Μάθηση - Machine Learning	6

Β΄ Εξάμηνο	
Μαθήματα Υποχρεωτικά	**ECTS**
Αλγόριθμοι στη Δομική Βιοπληροφορική - Algorithms in Structural Biology	6
Αλγόριθμοι στη Μοριακή Βιολογία - Algorithms in Molecular Biology	6
Μηχανική Μάθηση στην Υπολογιστική Βιολογία - Machine Learning in Computational Biology	6
Ανάλυση και Επεξεργασία Εικόνων - Image Processing and Analysis	6

2. Bioinformatics – Biomedical Data Science

Α΄ Εξάμηνο	
Μαθήματα Επιλογής (να επιλεγεί ένα)	**ECTS**
Αλγόριθμοι Ομαδοποίησης - Clustering Algorithms	6
Βιοστατιστική - Biostatistics	6
Επεξεργασία φυσικής γλώσσας - Natural Language Processing	6
Κοινωνικές Προεκτάσεις των Τεχνολογιών Γνώσης και 4η Βιομηχανική Επανάσταση - Social Implications of Knowledge Technologies and 4rth Industrial Revolution	6
Ανάλυση Δεδομένων Υψηλής Κλίμακας - Big Data Analytics	6
Μοριακή Μοντελοποίηση Βιομορίων - Modeling of Biomolecules	6
Συστήματα βάσεων δεδομένων - Database Systems	6
Τεχνολογίες Γνώσεων - Knowledge Technologies	6
Ειδικά θέματα Βιοπληροφορικής - Special Topics in Bioinformatics	6
Σύνολο (ECSTS)	30

2. Bioinformatics – Biomedical Data Science

Β΄ Εξάμηνο	
Μαθήματα Επιλογής (επιλέγεται ένα)	**ECTS**
Ανάλυση Γεωμετρικών δεδομένων - Geometric Data Analysis	6
Εφαρμογές Επιστήμης Δεδομένων και Τεχνολογιών Πληροφορικής στις Νευροεπιστήμες - Application of Data Science and Information Technologies in Neurosciences	6
Εφαρμογές Επιστήμης Δεδομένων και Τεχνολογιών Πληροφορικής στην Ιατρική - Applications of Data Science and Information Technologies in Medicine	6
Καινοτομίες Επιστήμης δεδομένων & Τεχνολογιών Πληροφορικής - Innovations in Data Science and Information Technologies	6
Νευρωνικά Δίκτυα βάθους - Deep Neural Networks	6
Διαχείριση Μεγάλων δεδομένων - Big Data Management	6
Ειδικά θέματα Βιοπληροφορικής - Special Topics in Bioinformatics	6
Σύνολο (ECTS)	30

Master's Thesis

Γ΄ Εξάμηνο	
Μαθήματα Υποχρεωτικά	**ECTS**
Εκπόνηση μεταπτυχιακής διπλωματικής εργασίας - MSc Thesis	30
Σύνολο (ECTS)	30

Conclusion - Why to study at the DSIT graduate program?

- Data Science and Artificial Intelligence are among the hottest fields of study
- Biomedical Data Science is a rapidly emerging field focusing on Biomedical Big Data analysis and modeling
- DSIT is among the most acclaimed Master's Programs offered in Greece (with nstruction in English)
- Multidisciplinary faculty of academic professors and researcher institute experts
- Highly selective, small classes, cross-disciplinary student body
- Large number of offered courses and electives
- Extensive research experience through a Master's thesis (one semester)
- DSIT graduates accept high quality jobs or continue their studies at the PhD level
- Scholarship opportunities for incoming and registered students
- Can also be pursued part-time and is affordable

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DEPARTMENT OF INFORMATICS & TELECOMMUNICATIONS
1989 - 2019 30 YEARS

We are proud of our students!

Our DSIT graduate student (Bioinformatics - Biomedical Data Science)

Mr Marios Gavrielatos (in collaboration with Konstantinos Kyriakides) won the first prize in the **Cancer Immunotherapy Data Science Grand Challenge** held by the Eric and Wendy Schmidt Center at the **Broad Institute** of MIT and Harvard, in collaboration with the Laboratory for Innovation Science at Harvard and other partners.

Challenge overview: https://lnkd.in/dB2UUZUZ

Host Challenge: https://lnkd.in/dAfTgspP

Challenge 1: https://lnkd.in/dc3u6utr

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Research Groups participating in the DSIT Program

(Partial List)

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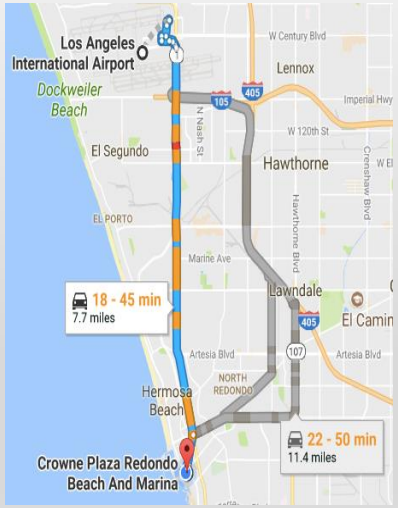
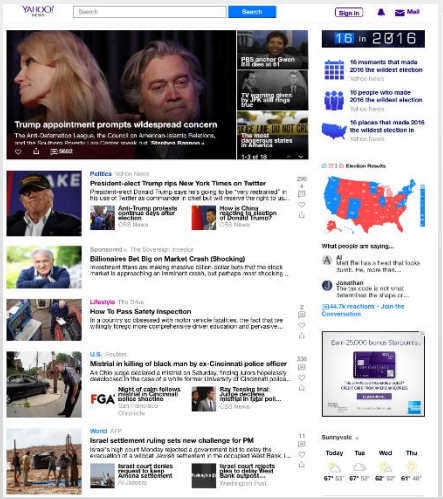
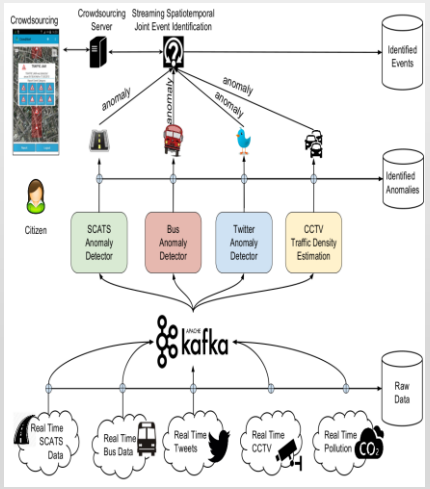
KDD Lab



Travel Time Estimation



First Story Detection



Real-time Traffic Monitoring

Knowledge Discovery in Databases (KDD) Group

- Smart Cities: Monitoring and planning
- Data, web, and text mining
- Social networks
- Data management and data science
- Map creation and self-driving car applications
- Time series and GPS trajectories analysis
- Fairness and explainability in Artificial Intelligence

Contact person: Prof. Dimitrios Gunopulos | dg@di.uoa.gr

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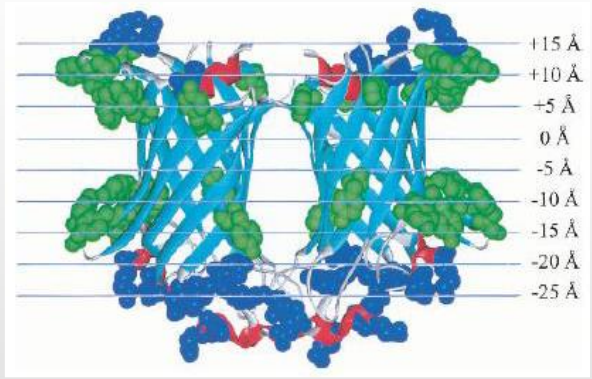
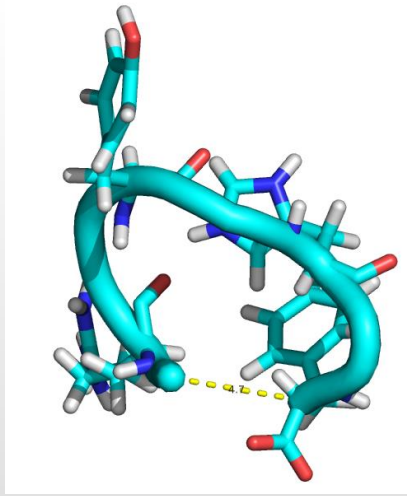
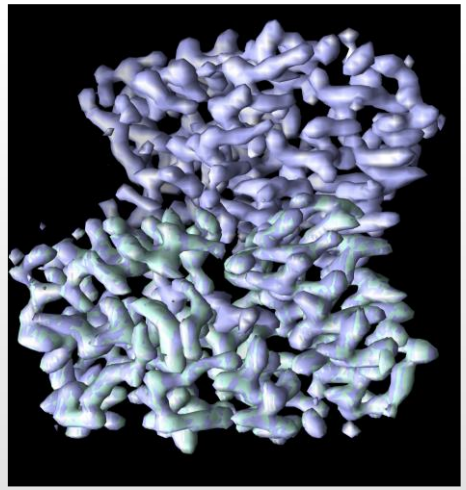
Algebraic and Geometric Algorithms Lab (ΕρΓΑ)

ΕρΓΑ
Laboratory of Algebraic and Geometric Algorithms







- Scientific and geometric computing
- Deep Geometric Learning
- Structural bioinformatics: 3d structure from NMR (distance) / CryoEM (image) data
- Motion planning and robotics

Contact person: Prof. Yiannis Emiris| emiris@di.uoa.gr

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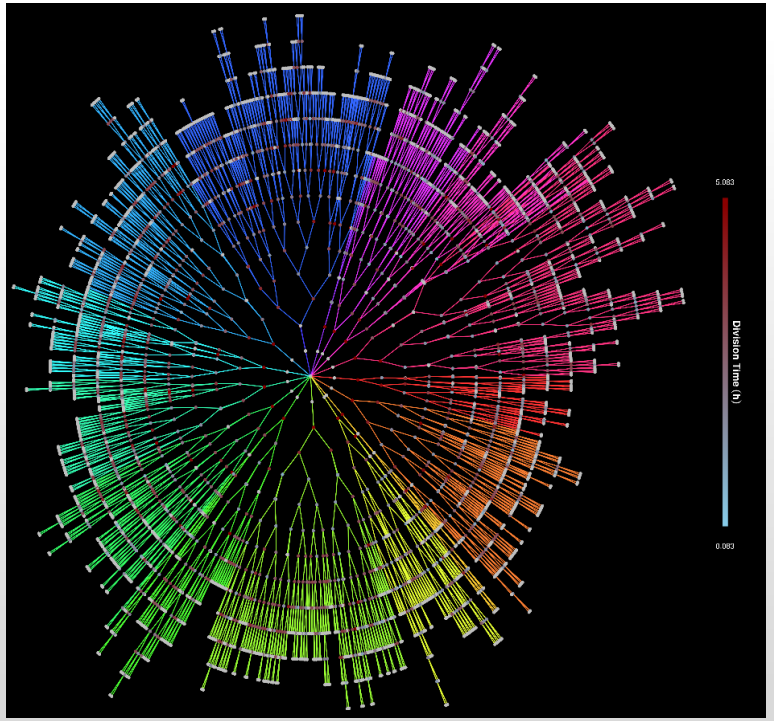
Information Technologies in Medicine and Biology Group

- Bioinformatics – Biomedical Data Science
- Statistical Signal / Image / Data analysis for biomedical applications
- Machine Learning for Systems Biology
  - Single-cell transcriptomics data analysis methods and tools
- Bioimage analysis – algorithms and tools
  - Bacterial single-cell segmentation, tracking, analytics (BaSCA tool)
- Machine/Deep Learning for Drug Discovery
  - Extracting knowledge from Molecular Dynamics trajectories
  - Protein structure comparison methods
- Mathematical modeling and simulation of biological systems
  - Neuro-informatics models of the PFC relevant to schizophrenia
  - Parallel stochastic simulation of large biochemical reaction networks
- Digital Twin technologies in Healthcare
  - Privacy preserving machine learning and simulation methods
- Machine learning for Ecological Modeling
  - Wildfires course prediction, simulation, and geo-animation
  - Distributed algorithms for continuous object tracking
- Citizens Science methods for Ecological Monitoring
  - Crowdsourced wildfire hotspot detection using smartphones



Representing single-cell diversity: A Forest of Division Trees of cell clones in a bacterial cell-movie (video). Data analysis and visualization using our BaSCA tool.

Each division tree captures a cell colony's proliferation. Branch colors represent the different colonies growing in the complex movie (15 in total). Node colors represent cell division times (in hours). They vary across tree branches (cell clones) and along tree levels (cell generations). ***Each cell is different!***

Contact person: Prof. Elias S. Manolakos | eliasm@di.uoa.gr

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Big Data Research Infrastructures

- Digital Research Infrastructures
  - Data services for Life Sciences
  - Data services for Industrial Biotechnology
- Explainable Artificial Intelligence
- Scientific databases
- Data Web and Information Retrieval
- Data interoperability and integration
- Bioinformatics

Contact person: Dr. Theodore Dalamagas | dalamag@athenarc.gr

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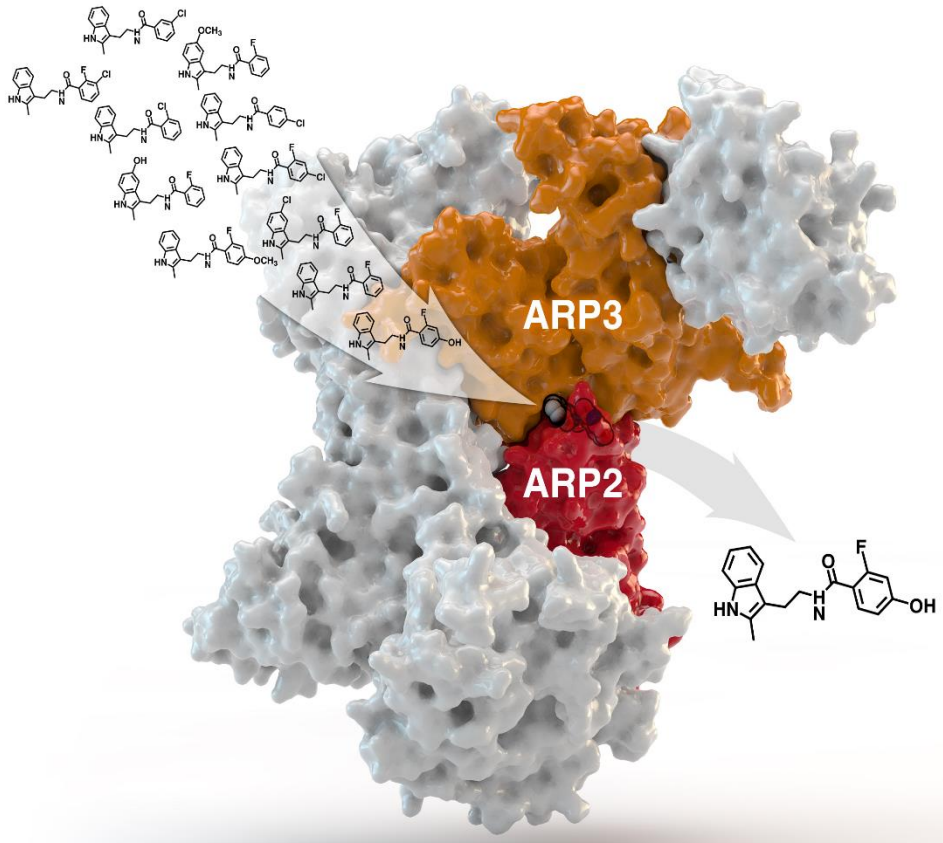
Molecular Modeling of Biomolecules with Applications in AI – Dr. Zoe Cournia (BRFAA)



- Hands on weekly exercises in computer lab
- High Performance Computing Basics
- Molecular Dynamics simulations of proteins
- Python workshop with Jupyter notebooks to analyze Molecular Dynamics simulations
- Chemoinformatics – programming in R
- Machine Learning exercises for calculating molecular properties
- Computer-aided drug design project with real-life applications
- Class tailored to each student goals

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Artificial Intelligence in Biomedicine and Molecular Epidemiology (BFRAA)

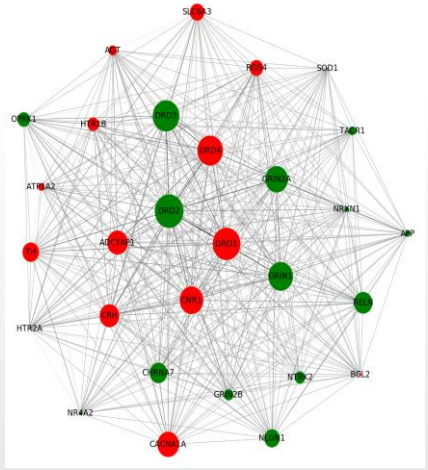
Topological analysis of Molecular networks, Ontological processing, Semantic Network Clustering, Integrative omics network analysis, Intelligent Pharmacogenomic analysis

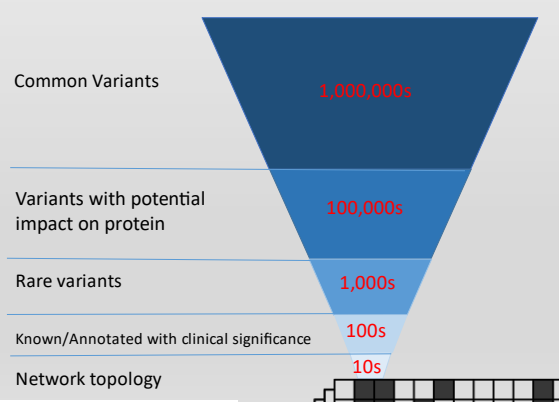
Screening the diversity of the microbial world, Metagenomics, Metatranscriptomics, Host pathogen interactions, Taxonomic/Phylogenetic analysis of metagenomic data, Automated characterization of metagenomes

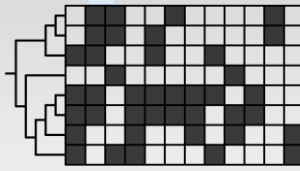
Clinical Information Mining, Composite Signatures, AI-driven Biomarker analysis

Biomedical Cloud Computing , Biomedical Big Data Automated processing

Metabolic Network analysis, Metabolomics/ Fluxomics, Large-scale metabolic reconstructions, In-silico virtual models







Contact person: Res Prof. Aristotelis Chatziioannou | achatzi@bioacademy.gr

Thank you!

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