

HELLENIC REPUBLIC National and Kapodistrian University of Athens



# 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** 





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

- National and Kapodistrian University of Athens (NKUA) di.uoa.gr
- Biomedical Research Foundation of the Academy of Athens (BRFAA) www.bioacademy.gr
- ATHENA Research Center

www.athenarc.gr

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

#### DEPARTMENT OF INFORMATICS + TELECOMMUNICATIONS



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- Offers a MSs degree in "Data Science and Information Technologies" («Επιστήμη Δεδομένων και Τεχνολογίες Πληροφορίας»)
- DSIT offers 2 specializations in:
  - 1. Big data and Artificial Intelligence
  - 2. Bioinformatics Biomedical data science
- The 2 specializations run in parallel, with overlap in the courses offered.





#### Salient characteristics of the program

- Program is operating since 2018
- $\circ~$  Is one of the most popular and sought after MSc Programs in Greece
- **Focused** program on two state-of-the-art specializations:
  - Big data and Artificial Intelligence
  - Bioinformatics Biomedical data science
- Small classes and selective: 20 students selected in each specialization
- Collaboration with two top research institutes offers the students the opportunity to work on advanced topics of their choosing
- ca80% of the instructors are professors at the University of Athens or researchers at the Athena RC or the Biomedical Research Foundation (all are PhDs)
- Mandatory MSc thesis further encourages research engagement by the students





## MSc in Data Science and Information Technologies (DSIT) Motivation for the program

- We are currently witnessing vast and rapid advances:
  - in the availability of data (instrumenting the world)
  - in the availability of computing power and always on connectivity
  - in learning from data

and their widespread application in Life Sciences.

- There is an acute need on a national and international level for graduates that can:
  - Deepen the understanding of the advances in these fields
  - Deepen their knowledge on the interdisciplinary methods and problems in the area





## MSc in Data Science and Information Technologies (DSIT) Goals of the program

- The program graduates should be:
  - fully equipped with a number of important skills in data science: algorithmic design, data management, data analysis, machine learning, bioinformatics
  - fully capable to continue their career in research, typically towards a PhD, to join a wide spectrum of industrial labs and organizations, or even to create their own companies





#### Overview

- Duration: Three semesters (18 months, max 36 months)
- Comprises 90 ECTS
- Students must complete 10 courses and a MSc Thesis (30 ECTS)
- Tuition: graduate students pay nine hundred euros (900 €) per semester, for three semesters.
- The program is designed for a duration of 3 semesters of full-time studies
- There is a part-time, 6 semester option
- o dsit.di.uoa.gr





#### Teaching staff

- Anastasiadou Ema BFRAA
- Cournia Zoe, BRFAA
- Chrysina Evangelia, BRFAA
- Dalamagas Theodore, Athena
- Doka Katerina, NTUA
- Emiris Ioannis, NKUA/Athena
- Gunopulos Dimitrios, NKUA
- Katsouros Vasilis, Athena
- Koubarakis Manolis, NKUA
- Koutrika Georgia, Athena

- Koutroumbas Kostantinos, Demokritos
- Linardatos Dionisios
- Manolakos Elias, NKUA
- Ntoulas Alexandros, NKUA
- Perantonis Stavros, Demokritos
- Pikrakis Aggelos, UPireus
- Roussou Maria, NKUA
- Stravopodis Dimitrios, NKUA
- Tsangaris Georgios, BFRAA
- Tsitsilonis Ourania, NKUA
- Vekrellis Kostas, BRFAA





#### Application process

- $\circ$  20 students selected in each specialization
- Applications currently accepted until June 2nd
- Acceptance announcements typically in less than 4 weeks
- Proof of competency in English and Bachelor's degree in related field are required
- $\circ~$  All application information available at: dsit.di.uoa.gr





#### Selection Criteria

- Primary undergraduate degree and degree specialization
- Undergraduate degree GPA
- Second/minor undergraduate degree or other graduate degree
- Reference letters
- Publications/research activity
- Interview





Application numbers (last 3 years statistics)

- 1. Data Science Specialization: ~107/year, 20 accepted
- 2. Bioinformatics Specialization: ~42/year, 20 accepted





#### Data Science – 1<sup>st</sup> semester courses

(M161) High Scale Analytics

(M 149) Database Systems

(M164) Knowledge Technologies

(M430) Machine Learning

(M402) Clustering Algorithms

(M404) Biostatistics

(M401) Natural Language Processing

(M409) Social Implications of the technologies of knowledge and 4th industrial revolution

(M421) Time series data analysis and applications

(M413) Introduction to Bioinformatics

(M725) Information Theory

(M414) Optimization - Theory and Algorithms

(M460) Special topics in Big data and Artificial Intelligence

#### 2<sup>nd</sup> semester courses

(M401) Deep Neural Networks

(M412) The Internet of things

(M411) Big data management

(M115) Image processing and analysis

(M104) Geometric data analysis

(M407) Application of Data Science and Information Technologies in Neurosciences

(M406) Applications of Data Science and Information Technologies in Medicine

(M408) Innovations in Data Science and Information Technologies

(M403) Algorithms in Molecular Biology

(M410) Machine Learning in computational biology

(M415) Computer Vision

(M460) Special Topics in Big Data and Artificial Intelligence





#### Bioinformatics– 1<sup>st</sup> semester courses

(M416) Biology -Physiology

(M413) Introduction to Bioinformatics

(M417) Introduction to Biotechnology

(M430) Machine Learning

(M402) Clustering Algorithms

(M404) Biostatistics

(M401) Natural language processing

(M409) Social Implications of Knowledge Technologies and 4rth industrial revolution

(M161) Ανάλυση Δεδομένων Υψηλής Κλίμακας - Big Data analytics

(M420) Modeling of Biomolecules

(M149) Database systems

(M164) Knowledge Technologies

(M480) Special Topics in Bioinformatics

#### 2<sup>nd</sup> semester courses

(M 103) (Algorithms in Structural Biology

(M403) Algorithms in Molecular Biology

(M410) Machine Learning in Computational Biology

(M115) Image processing and analysis

(M104) Geometric Data Analysis

(M407) Application of Data Science and Information Technologies in Neurosciences

(ME406) Applications of Data Science and Information Technologies in Medicine

(M408) Innovations in Data Science and Information Technologies

(M401) Deep Neural Network Architectures

(M411) Big Data Management

(M480) Special Topics in Bioinformatics





#### MSc Thesis

- <u>https://pergamos.lib.uoa.gr</u> includes 45 MSc Theses over the last few years
- The thesis is written in English
- There is an Advisor and a 3-person Thesis Examination Committee
- <u>https://pergamos.lib.uoa.gr/uoa/dl/frontend/el/search.html?p.tpl=grid\_lg&p.start=0&p.cou</u> nt=20&p.proto=%2Fbutterfly%2Fbackie%2Fborn\_digital\_postgraduate\_thesis&p.units=%2F <u>lib%2Fdefault%2Fdata%2F2820217</u>



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

Knowledge Discovery in Databases (KDD) Group

- Smart Cities: Monitoring and planning
- Data, web, and text mining
- Social networks
- Wireless sensor networks
- Data management
- Map creation and self-driving car applications
- Time series and GPS trajectories analysis



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#### MSc in Data Science and Information Technologies (DSIT)

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



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!* 





#### **Recent publications**

- Eleni Tsalapati, Markos Iliakis, Manolis Koubarakis, *Location Query Answering Using Box Embeddings.* Deep Learning for Knowledge Graphs Workshop. ISWC2023. Best workshop paper award.
- K. Stylianopoulos, K. Koutroumbas, *A probabilistic clustering approach for detecting linear structures in twodimensional spaces*, Pattern Recognition and Image analysis, Vol. 31, No. 4, pp. 671–686, 2021.
- K. Zagganas, M. Lioli, T. Vergoulis, T. Dalamagas, *Simplifying p-value calculation for the unbiased microRNA enrichment analysis using ML-techniques*, Proceedings of the Workshops of the EDBT/ICDT 2021 JointConference (1st International Workshop on Data Analytics and Machine Learning Made Simple SIMPLIFY), Nicosia, Cyprus, March 23, 2021.

#### **Recent Awards**

- DSIT student Marios Gavrielatos, 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. Link.
- Best workshop paper award: Eleni Tsalapati, Markos Iliakis, Manolis Koubarakis, Location Query Answering Using Box Embeddings. Deep Learning for Knowledge Graphs Workshop. ISWC2023





#### Tuition Information

- 900 euro for 3 semesters
- Approx. 30% do not pay tuition for financial reasons
- There are also 2 fellowships for academic excellence





### MSc in Data Science and Information Technologies (DSIT)

Support and Infrastructure

One full time support person: Ms. Kanavou





### MSc in Data Science and Information Technologies (DSIT) Strong Points:

- 1. Very competitive program with a large number of student applications
- 2. Strong focus on modern and very relevant topics
- 3. Great mix of students with computational/bioinformatics backgrounds
- 4. Good gender balance: 57.5% male and 42.5% female 2023 incoming class
- 5. Taught in English opening opportunities for non-Greek students
- 6. Compares very well with similar programs in Greece:
  - i. NTUA's Data Science and Machine Learning MSc Program
  - ii. Athens U. of Economics and Business Data Science MSc Program
- 7. Offers a unique very strong specialization in Bioinformatics





#### MSc in Data Science and Information Technologies (DSIT) Strong Points:

- 8. Strong and experienced teaching staff
- 9. Support from 3 leading research institutions
- 10. Strong emphasis on research and academic excellence
- 11. Multi-disciplinarity and outward-looking collaborations:

Students have done MSc theses in Harvard, Paris-Saclay, etc

 Excellent career prospects for graduates (PWC, Ballista, Ubitech, IBM,, LANGaware, Saphetor SA, ΕΛΒΑΛΧΑΛΚΟΡ, ΕΔΥΤΕ, SmartNS Technological S, BGM OMD, Amazon), with several continuing for PhD.



## Thank you!

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