

30 JUNE, 1 JULY & 3 JULY, 2011 / ALGARVE - PORTUGAL

# BIOINFORMATICS

## ADVANCED COURSE

### INSTRUCTOR

Professor S. Halgamuge  
The University of Melbourne,  
Australia

- AN OVERVIEW OF BIOINFORMATICS
- USE OF DYNAMIC PROGRAMMING
- SEQUENCE ALIGNMENTS
- CLUSTERING AND VISUALIZATION
- PHYLOGENETICS
- USE OF MARKOV MODELS
- PATTERN DISCOVERY AND RECOGNITION
- PROTEOMICS AND REGULATORY NETWORKS
- METABOLOMICS
- METAGENOMICS
- SELECTED EXAMPLES OF CURRENT RESEARCH



Local Advisor:  
Dr. António Gaspar Cunha  
[agc@dep.uminho.pt](mailto:agc@dep.uminho.pt)  
University of Minho  
Portugal

VENUE:  
HILTON VILAMOURA AS CASCATAS GOLF RESORT & SPA

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# ABOUT THE COURSE

Bioinformatics is considered as one of the technologies that will revolutionize the mankind in the 21<sup>st</sup> Century. It is the integration of Computer Science and Engineering to help solving challenging problems encountered in Biology.

The influx of data generated by the various genomic projects has led to a dramatic increase in research leading to very useful applications in Pharmaceutical industries and agriculture.

With the perspective of personalised Medicine in the near future, most medical research establishments are rapidly developing expertise in this new interdisciplinary area.

**The 3-day intensive course is aimed at presenting theory, current methods and exciting R&D work in bioinformatics highlighting applications useful in Drug Discovery and agriculture in a clear and easy to understand form.**

## THE COURSE CONSISTS OF:

**LECTURES** on Computational issues in Bioinformatics, methodologies (Multiple alignment methods in DNA and Protein Sequences, Hidden Markov Models, Dynamic, Programming, Clustering and Classification) and applications

**APPLICATION CASE STUDIES** on Motif Search, Motif Discovery, Species Separation, metabolomic data analysis and Splice Site Detection

**TUTORIALS** involving practice questions and software demonstrations

## WHO SHOULD ATTEND THIS COURSE?

This course offers R&D personnel, lecturers, programme managers, computer scientists, engineers and technical specialists an opportunity to appreciate the emerging area of Bioinformatics and to learn the methodology for applying algorithms, tools and techniques to specific areas of Bioinformatics.

Participants are assumed to have knowledge of basic mathematics and in particular probability.

Some knowledge of Biology and computer programming is an advantage, and but not essential.

## BENEFITS OF ATTENDING THE COURSE

At the end of the course, participants will have thorough understanding of pattern recognition issues involved in Bioinformatics and a practical understanding of how to apply some of these methods to their own problems and domains. Participant will also benefit from the examples taken from cutting edge research.

## COURSE CONTENTS

### 1- AN OVERVIEW OF BIOINFORMATICS

- What is Bioinformatics, and why is it important?
- Primer on molecular biology and genetics
- DNA, RNA, genes, gene expression genetic
- What is System Biology?
- A brief history of Bioinformatics
- What areas in Mathematics and Computer Science are involved
- Biologically inspired computing

### 2 - SEQUENCE ALIGNMENTS

- Introduction to Dynamic Programming
- The Smith-Waterman algorithm
- Database searches
- Alignment scores and statistical significance of database searches;
- Multiple sequence alignment

### 3 - CLUSTERING AND VISUALIZATION

- Unsupervised Clustering Methods
- Dimensionality and Data Reduction
- Application Examples in Metagenomics: Species
- Separation with Clustering
- Micro Array Data Analysis

### 4 - PHYLOGENETICS

- Introduction to phylogenetics (distance based and character based)
- Phylogenetic trees
- Distance matrix methods
- Maximum likelihood approaches
- Parsimony and ancestral sequences
- Comparison of phylogenetic methods

### 5 - USE OF MARKOV MODELS

- Markov Models in Bioinformatics
- Hidden Markov models: Viterbi, forward, backward algorithms
- Application Examples

### 6 - PATTERN DISCOVERY AND RECOGNITION

- Gene finding
- Motif Search and discovery
- Gene structure, open reading frames and gene expression
- Alternative Splicing
- Microarrays

### 7 - PROTEOMICS AND REGULATORY NETWORKS

- Introduction to proteomics - protein structure; protein classification
- Protein and RNA structure prediction
- Protein folding
- An introduction to Regulatory Networks

### 8- METABOLOMICS

- An introduction in the context of Agriculture
- Algorithmic challenges involved and opportunities for research
- Case Studies on Drought Tolerant Plants

### 9- METAGENOMICS

- An introduction describing why this area is different
- Key applications using pattern discovery
- Use of Metagenomics in Drug Discovery

### 10 - SELECTED EXAMPLES OF CURRENT RESEARCH

- Splice Site Detection with Markov models and Neural Networks
- Who has the best wheat?
- Semi-supervised Learning applied to Bioinformatics
- Locating CRISPR Sequences

# ABOUT THE INSTRUCTOR



## **ABOUT THE INSTRUCTOR**

[http://www.mech.unimelb.edu.au/people/staff/saman\\_halgamuge.html](http://www.mech.unimelb.edu.au/people/staff/saman_halgamuge.html)

Dr. Halgamuge is a Professor in the Melbourne School of Engineering of The University of Melbourne and a member of the school wide initiative of Biomedical Engineering. He received Dipl.-Ing (1990) and Dr.-Ing (1995) degrees in Electrical Engineering from Technical University of Darmstadt, Germany.

He leads a group of postdoctoral fellows and PhD students working on Pattern Recognition and Optimization looking into problems in Bioinformatics and Sustainable Energy.

Dr. Halgamuge is the co-author of over 50 journal papers, 150 conference papers (h-index 20) and 15 book chapters. Among them are 6 top ranked journal papers based on ISI citations in their respective journals.

The 8 books edited by Dr. Halgamuge include: *Frontiers in the Convergence of Bioscience and Information Technologies* (IEEE Computer Society Press, 2007);

*Classification and Clustering for Knowledge Discovery* (Springer), 2005 and *Computational Intelligence for Modelling and Prediction* (Springer), 2005.

Dr. Halgamuge serves on the editorial boards of 6 journals, chaired about 12 conferences and served as a member of about 70 international program committees. He is an Associate Editor of *BMC Bioinformatics*.

He has conducted international consultancies for UNDP and was an expert technical adviser to the Australian government Department of Health and Ageing.

# COURSE VENUE

## **Hilton Vilamoura As Cascatas Golf Resort & Spa**

Rua da Torre d'Agua, Lote 4.11.1B  
8125-615 Vilamoura  
Quarteira, Algarve  
Portugal



*Special Rates for course participants!  
Contact us!*

# REGISTRATION

NOTE: this course is limited to a small number of participants, reserve your place soon (max. of 25 participants)

REGISTRATION FEE: 980 EUR \*

(\*) REGISTRATION INCLUDES:

- ✓ 3 FULL DAYS COURSE,
- ✓ PRINTED COURSE MATERIALS,
- ✓ COURSE CERTIFICATE,
- ✓ 2 REFRESHMENTS DAILY,
- ✓ LUNCH AT HOTEL VENUE (DAILY / 3 DAYS).

Early registration = 980 EUR \* (till 15 March, 2011)  
After = 1,280 EUR

Contact:

**Dr. Meire Gomes**

[meire.gomes@ironix-conferences.com](mailto:meire.gomes@ironix-conferences.com)

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Local Advisor (Scientific):

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## IRONIX - CONTINUING EDUCATION:

BIOINFORMATICS

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*Please print or type all information on this form and send us back by Fax or e-mail: FAX: ++00 351 234 410 097*

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## REGISTRATION FORM

Prof.  Dr.  Mr.  Ms.

Your Full Name

E-mail

Department

Institution / Company Name

Mailing Address

City

Zip / Postal Code

Country

Registration Fee:

Early registration = 980 EUR \* (till 15 March, 2011)

After = 1,280 EUR

PAYMENT CAN BE DONE BY BANK TRANSFER or BY CREDIT CARD:

**Bank Transfer:**

*(Please attach a copy of the receipt of remittance to this form)*

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**Credit Card:**

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(\* Registration cancellations must be received by March 30, 2011 for a refund and note that a 100 EURO administrative fee is not refundable. Please note that refunds will be done after the EVENT for administrative reasons.