

How to do other SIRI Activities (during covid-19 confinement)

(NEW) New state of the art work in this document and new online summer school seminar (ACACES)

Hope you and your family are all fine. All the best wishes for you!

This document tries to help you to find SIRI activities (online) to mitigate the effects of confinement due to covid19. On the other hand, you **should try** to do all the courses before 29th of May of 2020. However, we are conscious of the difficulties of finding SIRI activities and we will be flexible with this deadline.

As a reminder, in the [Guide for SIRI activities](#) you can find alternatives to those SIRI activities [already published](#) (which may be cancelled due to covid19). However, it is clear that most of the alternatives may not be possible neither. During this closing time there are not too much possibilities of doing hands-on, conferences, **unless they have online version, and in that case you can do them!**

For this reason, one possibility is that you try to look for online courses related (**but not limited**) to your area/specialization. Once you find a course interesting for you, you should follow the steps described at **point 8 of the [Guide for SIRI activities](#)** .

In order to obtain the ECTS for any of the online courses below:

1. You should submit a guided work proposal under the supervision of a tutor, for an specific MIRI specialization. If you don't find any tutor in the specialization it is better that you contact the coordinator of the MIRI specialization the course belong to.
2. Then, you will have to wait until the proposal is validated by the coordinator of the MIRI specialization. If the course is in the list below, this will be validated for sure, and in this case, you can start the work before it is validated.
3. You have to do the work of the online course and present evidences of the work done to your tutor. You don't need the official certificate given by the online coursera/course if that means that you have to register and pay the course. Talk to your tutor in order to know which are the evidences she/he needs.
4. Your tutor will have to evaluate the work and/or certificate the work. This is the certification you should use in next step.
5. Then, you should upload the certificate or evaluation done by the tutor in the previous step to the SIRI website.
6. Finally, the coordinator of the MIRI specialization will validate the work, and the activity ECTS will be added to the set of SIRI ECTS you have.

7. Once you have 6 ECTS of SIRI activities, you can enroll SIRI if you have not done that yet.

For your information, we provide you a list of online courses (below) that were previously done by other students and other courses that the coordinator has also suggested. **HOWEVER, you are not limited to this list and if you find anything else you like it, you can suggest it to a tutor and the coordinator of the speciality.** In any case, you should follow the steps mentioned at point 8 of the [Guide for SIRI activities](#). Finally, if you don't find anything you like it you can directly contact the coordinator of the speciality so that he/she can advise you about which online course to do. If you have problems to get a tutor, contact the coordinator of your specialization with cc to vd.postgrau@fib.upc.edu, so that we can help you.

The coordinators of the MIRI specializations are:

MIRI-AC: Jordi Petit (jpetit@cs.upc.edu)

MIRI-CGVR: Nuria Pelechano (npelechano@cs.upc.edu)

MIRI-CNDS: Jose M. Barceló (joseb@ac.upc.edu)

MIRI-DS: Oscar Romero (oromero@essi.upc.edu)

MIRI-HPC: Josep Llosa (josepll@ac.upc.edu)

The **current** list of online courses (previously done by other students or suggested by the coordinators) in which you can be interested can be found below. This list would probably be updated quite often with new courses, so stay tuned!

MIRI-AC

- Modeling for Discrete Optimization (**3 ECTS**)
<https://www.coursera.org/learn/advanced-modeling>
- Approximation algorithms Part-1 (**2 ECTS**)
<https://www.coursera.org/learn/approximation-algorithms-part-1>
- Approximation algorithms Part-2 (**1 ECTS**)
<https://www.coursera.org/learn/approximation-algorithms-part-2>
- Algorithms on strings (**1.5 ECTS**)
<https://www.coursera.org/learn/algorithms-on-strings>
- Parallel Programming in Java (**1.5 ECTS**)
<https://www.coursera.org/learn/parallel-programming-in-java>
- Concurrent Programming in Java (**1.5 ECTS**)
<https://www.coursera.org/learn/concurrent-programming-in-java>
- Computational Complexity Theory (**5 ECTS**)
<https://mycourses.aalto.fi/course/view.php?id=20593>
- Advanced Data Structures (**3 ECTS**)
<https://ocw.mit.edu>

MIRI-CG&VR

- Complete C# Unity Developer 3D: Learn to Code Making Games.
Udemy course on Unity **(3 ECTS)**
<https://www.udemy.com/course/unitycourse2/>
- Unreal Engine and C++ (3ECTS)
An Udemy course on Video Game Development, a branch of Computer Graphics, focused on the Unreal Engine and C++ coding. This is the link to the course:
<https://www.udemy.com/course/unrealcourse/>
- RPG Core Combat Creator: Learn Intermediate Unity C# Coding (3ECTS)
The course is focused on building a Role Playing Game (RPG) in Unity, while improving your C sharp, code architecture, game & level design.
Full game scale. <https://www.udemy.com/course/unityrpg/>

MIRI-CNDS

- Big Data Emerging Technologies **(1 ECTS)**
<https://www.coursera.org/learn/big-data-emerging-technologies>
- Online course on Android Applications **(1 ECTS)**
<https://www.udemy.com/learn-android-application-development-y/>
- Online courses on ASP.NET and Computer Security **(2 ECTS)**
Learn Ethical Hacking From Scratch (13.5 hours of video)
<https://www.udemy.com/learn-ethical-hacking-from-scratch/learn/v4/overview>
The Complete Cyber Security Course, volume 1 (12 hours of video)
<https://www.udemy.com/the-complete-internet-security-privacy-course-volume-1/learn/v4/overview>
Complete ASP.NET Core 2.1 Course (9.5 hours of video)
<https://www.udemy.com/complete-aspnet-core-21-course/>
- Cyber Attack Countermeasures **(1.5 ECTS)**
<https://www.coursera.org/learn/cyber-attack-countermeasures>
- Blockchain: Foundations and Use Cases **(0.5 ECTS)**
<https://www.coursera.org/learn/blockchain-foundations-and-use-cases>
- Software Security **(1 ECTS)**
<https://www.coursera.org/learn/software-security>

MIRI-DS

- TensorFlow in Practice **(2 ECTS)**
<https://www.coursera.org/specializations/tensorflow-in-practice>
- Deep Learning Specialization - 1 course **(1 ECTS)**
<https://www.coursera.org/specializations/deep-learning>
- Bayesian Methods for Machine Learning **(1.5 ECTS)**
<https://www.coursera.org/learn/bayesian-methods-in-machine-learning>
- Practical Reinforcement Learning **(1.5 ECTS)**
<https://www.coursera.org/learn/practical-rl>
- CLOUDERA DEVELOPER TRAINING FOR SPARK AND HADOOP **(2 ECTS)**
www.cloudera.com
- Neural Networks and Deep Learning Coursera Course **(1 ECTS)**
<https://www.coursera.org/learn/neural-networks-deep-learning>
- Full program in Deep Learning – Five courses **(5 ECTS)**

- <https://www.coursera.org/specializations/deep-learning>
- [Coursera] Natural Language Processing (2 ECTS)
<https://www.coursera.org/learn/language-processing>
- Scala and Spark for Big Data and Machine Learning (1 ECTS)
<https://www.udemy.com/scala-and-spark-for-big-data-and-machine-learning/>
- Convolutional Neural Networks (Coursera Deep Learning Course) (2 ECTS)
<https://www.coursera.org/learn/convolutional-neural-networks>

MIRI-HPC

- Embedded Software and Hardware Architecture (1 ECTS)
<https://www.coursera.org/learn/embedded-software-hardware>
- Embedded Hardware and Operating Systems (1 ECTS)
<https://www.coursera.org/learn/embedded-operating-system>
- Fundamentals of Parallelism on Intel Architecture (1 ECTS)
<https://www.coursera.org/learn/parallelism-ia>
- Introduction to FPGA Design for Embedded Systems (1 ECTS)
<https://www.coursera.org/learn/intro-fpga-design-embedded-systems>
- Computer Architecture (2 ECTS)
<https://www.coursera.org/learn/comparch>
- TensorFlow in Practice (2 ECTS)
<https://www.coursera.org/specializations/tensorflow-in-practice>
- Neural Networks and Deep Learning Coursera Course (1 ECTS)
<https://www.coursera.org/learn/neural-networks-deep-learning>
- Convolutional Neural Networks (Coursera Deep Learning Course) (2 ECTS)
<https://www.coursera.org/learn/convolutional-neural-networks>

State of the art/Surveys and Local Research Group Collaborations (NEW)

We have also contacted all the professors of MIRI and all departments associated to the FIB to ask them if they have any possible tutored work in collaboration with their research groups and/or state of the art work proposals. Those works can be SIRI activities and are related to points 7 and 5 of the [Guide for SIRI activities](#), respectively.

We can provide you a list of the guided works suggested so far (below) by some of the professors. You can directly contact them with cc the coordinator of the speciality. **HOWEVER, you are not limited to this list and if you find anything else you like, you can suggest it to any professor of MIRI, and then, contact the coordinator of the specialty.** In any case, you should follow the steps mentioned at point 5 or 7 of the [Guide for SIRI activities](#).

In addition, library services has informed us that they can individually assist you with the bibliography search for the state of the art or related work of the research group collaboration (contact person e-mail: ruth.inigo@upc.edu).

The **current** list of proposed research tutored works can be found below. This list would probably be updated quite often with new proposals, so stay tuned!

- **Title of the work/collaboration:** Multiagent system for network control

Number of hours: 70 h (3 ECTS)

Contact Person : Luis Velasco

e-mail: lvelasco@ac.upc.edu

Brief Description: The project targets the development of a knowledge management framework for packet networks. ML agents running in the routers will exchange data and ML models for the incoming and outgoing traffic, as well as other control data. The multi-agent system will be managed by a centralized SDN controller that will supervise the decisions of the ML agents and will solve conflicts, while giving a complete network vision. The ML agents will be implemented in python and will communicate with each other using REST-APIs (HTTP) and json. The students will start from a framework that consists of the ONOS SDN controller that controls underlying agents and will extend it with the multi-agent functionality. Based on this work, there is room for extending the ML agents with Reinforcement learning for the autonomous control of the routers, which can be performed as a final thesis for the MIRI

The work will be carried out in collaboration with Telefónica and other major European operators with in the European project METRO-HAUL.

- **State of the Art** in Optimization Models for Cancer Genomics with Research Group ALBCOM

Number of hours: 50 (2 ECTS)

Contact Person: Gabriel Valiente

e-mail: gabriel.valiente@upc.edu

Brief Description: DNA sequencing allows the detection and quantification of frequencies of somatic single nucleotide variants (point mutations) in heterogeneous tumor cell populations. The problem is to reconstruct the evolutionary history (a phylogenetic tree) of the tumor cell population present is a set of samples from these frequency measurements, for which several optimization (integer linear programming) models have been proposed in the last few years.

- **State of the Art** in Energy-aware virtual machine allocation as an extension of bin-packing optimization

Number of hours: 50 (2 ECTS)

Contact Person: Jordi Guitart

e-mail: jguitart@ac.upc.edu

Brief Description: The problem of allocating virtual machines on physical hosts has been typically defined (and solved) as a bin-packing problem, given the

similarities between the two problems. But the VM allocation is more complicated than bin-packing because 1) Several resource dimensions (CPU, memory, disk) determine the host capacities and VM sizes, 2. The performance of a host degrades when it is overloaded (or close to), 3. Hosts are heterogeneous: they can have different capacities and power consumption profiles (which are non-proportional regarding the load of the host), 4. Activating/deactivating hosts incur a performance and energy cost, 5. The number of hosts is finite, constraining the number of VMs that can be allocated, 6. The number of VMs and the number of available hosts are volatile (may change over time), 7. VM migrations can be used for 'repacking' but they incur a performance and energy cost.

According to this, this work involves revisiting the solutions to the bin-packing problem (and its variants) and review whether they can be used to address the previous issues in a general context (and how), and also how those issues are being currently considered in the specific context of VM allocation solutions.

A good mathematical background would be useful for this work

- **State of the Art** in AI accelerators

Number of hours: 50 (2 ECTS)

Contact Person: Sergi Abadal

e-mail: abadal@ac.upc.edu

Brief Description: Training and inference in neural networks have become fundamental and pervasive computational workloads in today's computers from the very edge to the cloud and HPC environments. As a result, there have been a wide variety of efforts directed at building hardware accelerators specialized for AI computing workloads. The student will have to dive into the state of the art in this area to understand the latest trends in the design of AI accelerators, the unique traits of the different designs, and perform a small comparison of the reported performance/energy of the different works.

- **State of the Art** in Deep Learning techniques for cybersecurity in FoG computing

Number of hours: 50 (2 ECTS)

Contact Person: Eva Rodríguez

e-mail: evan@ac.upc.edu

Brief Description: The widespread use of mobile devices, as well as the increasing popularity of mobile services and applications has raised serious cybersecurity challenges. In the last years, the number of cyberattacks has grown dramatically, as well as their complexity. Therefore, there is a growing need for companies and individuals to protect their personal data and network equipment from cyber-attacks. This led cybersecurity systems embrace Deep Learning (DL) models. On the other

hand, IoT applications require novel cybersecurity controls, models, and decisions distributed at the edge of the network. In light of this, we propose to conduct a survey that review cybersecurity research based on DL in fog computing ecosystem, which supports IoT applications, in three different domains: infrastructure, software and privacy.

- **State of the Art** in in Graph Neural Network processing in the Barcelona Neural Networking center (BNN-UPC) **(NEW)**

Number of hours: 50 (2 ECTS)

Contact Person: Albert Cabellos / Sergi Abadal

e-mail: acabello@ac.upc.edu / abadal@ac.upc.edu

Brief Description: Recent times have seen the emergence of graph neural networks (GNN), a new set of algorithms that allow to infer the characteristics of edges, vertices, or a complete graph, with amazing applications in domains such as computer networks, social networks, quantum chemistry, or computer vision. The graph organization of data in these domains render existing neural networks (multi-layer perceptron, convolutional, recurrent) ineffective and require of these new GNNs instead. This poses new challenges from the algorithmic, processing, and application perspectives. The student will dive into this exciting new domain and study the latest works in one or more than one of these aspects: (i) algorithms and software optimizations, (ii) processing and hardware optimizations, (ii) novel applications.