UNIMORE
UNIVERSITÀ DEGLI STUDI DI
MODENA E REGGIO EMILIA

Dipartimento di Scienze Fisiche,
Informatiche e Matematiche

Theses and Internships

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General rules

- Here you can find a list of available Bachelor and Master thesis available, along with internships. There may be also novel projects available, so please check with me if you are interested in these topics for the newest offers.
- I am always happy to work with Bachelor and Master students, and I am glad that you are considering one of the topic I propose. Undergoing a thesis work is a key step in your education, and it is a challenging yet rewarding experience. The following rules are meant to be a guideline so that both you and me can carry the project in an efficient manner.
  - **Take your time**: a good bachelor thesis requires around 3 months, while a Master thesis can take 6 months or even more. If you are interested in one or more topics, ask in advance, even if you have not finished your exams yet. Moreover, if you are interested in one of the topics listed in these pages, say it upfront.
  - **Be efficient with communication**: when reporting your work, one email per month is too few, one per day is too much. Be efficient in what you communicate and how you do so.
  - **I am not gdb (or similar)**: do not send me code saying "it does not work". Explain what you have tried, on what circumstances you experience any problem. Be proactive, be clear.
  - **How to write**: we will use LaTeX, which may seem difficult at the beginning but you will benefit a lot from it at the later stages. A good tool to share the thesis work is Overleaf.
  - **The Internship/thesis is YOUR responsibility**: I will not remind you about deadlines, documents to fill, bureaucracy and alike. It is your responsibility to perform these tasks.

IoT and WoT

Web of Things and Fluid Computing

- Abstract: Extending the WoT standard with computation services, leveraging the WoT definition to extend it towards providing a standardized approach to a computing service.
- Expected effort: 4–6 months
- Material to start: attached to these slides (not yet published)

Fluid Computing in Wearable devices

- Abstract: Implement Fluid Computing capabilities over wearable devices (Movesense). This thesis addresses the possibility to offload part of the computation to an edge server, while providing the possibility to run part of a pipeline on a wearable device.
- Expected effort: 4–5 months
- Material to start: attached to these slides (not yet published)

TinyML

Split Computing and TinyML

- Abstract: Develop a library for TinyML which allows offloading part of the neural network to an Edge server. The library should make it easy to convert existing models in the TinyML format, and deploy them over microcontrollers (e.g. ESP32)
- Expected effort: 3–4 months
- Material to start:
  - https://doi.org/10.1145/3527155
  - attached to these slides (not yet published)

Split Computing and TinyML

- Abstract: test different network protocols to perform the offloading to the Edge. These include (but are not limited to) MQTT, CoAP, HTTP, ZeroMQ, Websocket. The test will make use of an already developed testing platform for split computing.
- Expected effort: 3–4 months
- Material to start:
  - https://doi.org/10.1145/3527155
  - attached to these slides (not yet published)

Split Computing and TinyML

- Abstract: Perform performance evaluation of TinyML and Split computing over different networks. These include (but are not limited to) WiFi, BLE, LoRa. The test will make use of an already developed testing platform for split computing.
- Expected effort: 3–4 months
- Material to start:
  - https://doi.org/10.1145/3527155
  - attached to these slides (not yet published)

Activity Recognition

Daily activities recognition

- Abstract: User monitoring can be done with wearables, and this thesis focuses on the recognition of key activities in a day for patients with different pathologies. The thesis topics are mainly related to data analysis and data science.
- Expected effort: 3–4 months
- Material to start:
  - https://doi.org/10.1109/PERCOMW.2018.8480119
  - https://doi.org/10.1002/wcm.2702

Multi–user activity recognition

- Abstract: Activity recognition is widely studied for single users activities, but less for multi users activities. This thesis focuses on the recognition of activities performed by a group of users (at least 2), such as shaking hands, walking together, recognizing physical signals (e.g. pointing at a user) directed towards a specific user. The work will focus on classical activity recognition with the addition of network communication.
- Expected effort: 5–6 months
- Material to start:
  - https://doi.org/10.1109/PERCOMW.2018.8480119
  - https://doi.org/10.1002/wcm.2702

Crowdsensing

Crowdsensing

- Abstract: Leveraging open GPS datasets, the goal of this project is to determine whether there are multiple routes in a city which are used by drivers to reach a common point, depending on the time of the day, weather conditions and other parameters
- Expected effort: 3–4 months
- Material to start:
  - https://doi.org/10.1109/JIOT.2017.2720855
  - https://doi.org/10.1145/3582515.3609528

Crowdsensing

- Abstract: Compute the costs to deploy and maintain an infrastructure to sense specific data. Then it is possible to determine what is the price someone is allowed to pay to users if the same data is obtained through crowdsensing. The system should leverage open data and real parameters
- Expected effort: 3–4 months
- Material to start:
  - https://doi.org/10.1109/JIOT.2017.2720855
  - https://doi.org/10.1109/TMC.2019.2921962

Crowdsensing

- Abstract: Through the analysis of user reports in a deployed crowdsensing application, this thesis focuses on understanding patterns about user communication to the central platform
- Expected effort: 3–4 months
- Material to start:
  - https://doi.org/10.1109/JIOT.2017.2720855
  - https://doi.org/10.1145/3582515.3609528

Crowdsensing

- Abstract: Through the analysis of images, this thesis focuses on the classification of issues in smart cities such as potholes, broken trees, waste and alike. A dataset of images is available
- Expected effort: 4–5 months
- Material to start:
  - https://doi.org/10.1109/JIOT.2017.2720855
  - https://doi.org/10.1145/3582515.3609528

Crowdsensing

- Abstract: Realize a mobile application which integrates the IOTA blockchain in a crowdsensing platform. The application should act both as a client (e.g. getting data and sending it to the blockchain) and verifier (e.g. veryfying transactions sent by other clients).
- Expected effort: 4–5 months
- Material to start:
  - https://doi.org/10.1109/JIOT.2017.2720855
  - https://doi.org/10.1145/3628354.3629531