Issue 4 | April 2020

MASTER

Multiple ASpects TrajEctoRy management and analysis

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Editorial

Welcome to the fourth issue of the MASTER newsletter!

We are now at halfway of the MASTER project. I am very proud of the results of the projects so far, in terms of successful secondments executed, research results obtained, papers published, events organized, networking, communication and dissemination activities giving visibility of the project. However, what is, in my opinion, the real added value of a RISE project, is something that has a more long term impact in the career and personal growth of secondees: the "holistic" experience of their secondments, as they reported in their feedback interviews. I feel delighted to read the secondees feedbacks, where they report "a great research and living experience" or "the experience that opens the mind" or "insightful, rewarding, unforgettable" experience. Some of their feedbacks are reported in this and previous issues. I strongly believe that a positive secondment experience has to be considered as the most significant impact in terms of the enhancement of secondees life and career.
These extremely positive results in terms of both research results and secondment experience have been reached thanks to the MASTER consortium: the secondees for their willingness to travel, learn and adapt to very different, not always easy environments, and the hosting partners for their welcoming attitude and precious support to visiting foreign researchers making them feel "at home". I feel very grateful to all of them, the excellent results of the project are their results.

This issue reports the project activities from September 2019 to February 2020.
We have selected two very recent research contributions. The first highlight entitled "Predicting Fishing Effort and Catch in the Northern Adriatic Sea: an example of Semantic Trajectories and Machine Learning" by Marta Simeoni reports on the result of the collaboration between the University Ca' Foscari of Venice (Italy) with Dalhousie University (Canada). The contribution is a framework for the forecasting of the fishing catch effort in the North Adriatic Sea. The Northern Adriatic Sea area is known to be one of the most exploited areas of the Mediterranean Sea, causing an over-exploitation of the fish resources. The development of effective fishery management plans is needed to make fishing activities sustainable and ensure a productive and healthy ecosystem.

The second article entitled "Uncovering hidden concepts from AIS data: a network abstraction of maritime traffic for anomaly detection" by Ioannis Kontopoulos, Iraklis Varlamis, Kostantinos Tserpes, presents the result of our partner Harokopio University proposing a novel use of a density-based clustering algorithm for AIS (a vessels tracking data standard) positions. The result of the algorithm is a set of clusters from multiple vessels, indicating different vessel behaviors in terms of speed, heading and distance.

The third article entitled "Prospective Data Model and Distributed Query Processing for Mobile Sensing Data Streams" by Mariem Brahem, Karine Zeitouni, Laurent Yeh, and Hafsa El Hafyani from University of Versailles Saint Quentin, reports on a Mobile Crowd-Sensing (MCS) approach as a new paradigm to collect massive-scale rich trajectory data where people become sensors and collect observations on their state, their behavior and/or their surrounding environments.

We also report on the 13 secondments executed from our staff in the period from September 2019 to February 2020 to Dalhousie University, Federal University of Santa Catarina, Pontificial Catholic University of Rio de Janeiro and Federal University of Ceara'.

As past events, we report the First MASTER workshop held in conjunction with ECML-PKDD conference in Wurzburg, Germany on September 16th, 2019. The workshop formal proceedings have been published Open Access by SpringerOpen financially supported by MASTER. We also report on the partners participation in BRIGHT events in Pisa (Italy) and Athens (Greece). We also highlight the upcoming events, unfortunately all postponed due to the virus outbreak: MASTER summer school, ESOF conference and MASTER Second workshop.

You can download this and previous issues of the newsletter from the MASTER web site: **www.master-project-h2020.eu**

Stay tuned and happy reading!

Chiara Renso, Project Coordinator

Predicting Fishing Effort and Catch in the Northern Adriatic Sea: an example of Semantic Trajectories and Machine Learning

Marta Simeoni, University Ca' Foscari Venice, Italy

The Northern Adriatic Sea area is known for its very high productivity and is recognized to be one of the most exploited area of the Mediterranean Sea, causing an over-exploitation of the fish resources. The development of effective fishery management plans is needed to make fishing activities sustainable and ensure a productive and healthy ecosystem. In this context, forecasting the fishing activities and their catches in space and time represents a step forward to assess the efficiency of the currently adopted measures and to develop new ones. Main stakeholders interested to accurate predictions are local/regional Administrations, Ministry of Agricultural, Food and Forestry Policies and Fishermen associations.

In our project, we explore a unique, high-value dataset obtained thanks to the collaboration with the stakeholders that provided the raw data. The dataset results from the fusion of three data sources for the biennium 2015-2016:

- Automatic Identification System (AIS) raw data, provided by the Italian Coast Guard, of the fishing vessels operating in the Northern Adriatic Sea. AIS data allows the reconstruction of the boat trajectories and the analysis of the fishing activities (fishing, not fishing);
- Daily landing reports (i.e., the quantity and type of fish caught) obtained from the Chioggia's Fish Market, whose harbor hosts one of the main fishery fleet of the Adriatic Sea. Landing data allows for distributing the catches along the fishing vessels trajectories, thus adding a valuable semantic information;
- Environmental information such as sea surface temperature and chlorophyll concentration, that could influence the species distribution, and waves height that could affect the fishermen behavior.

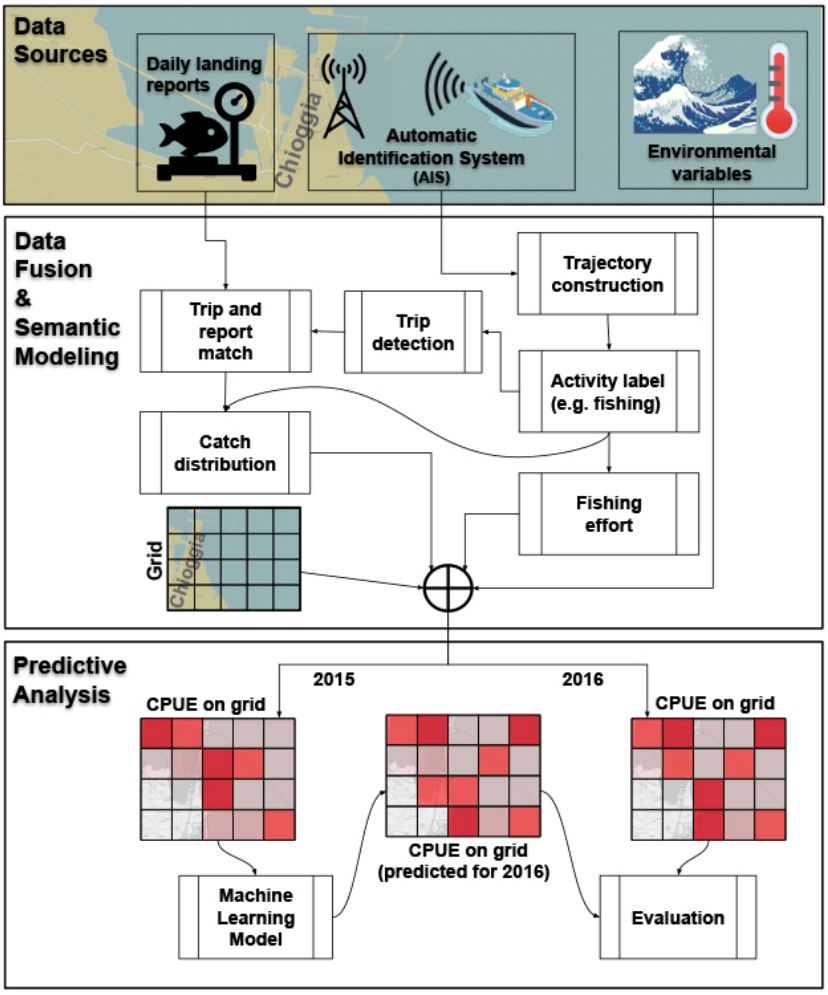


Figure 1: An overview of all the steps of the framework for predicting fishing catches

Having this dataset, our goal is to predict the future Catch Per Unit Effort (CPUE) from the past data. CPUE is an indicator of fishing resources exploitation that allows for assessing the pressure of these activities at the eco-

neous data sources; (ii) extracts knowledge from the integrated data using semantic trajectory modeling; and (iii) applies Machine Learning to learn from those semantic trajectories a model for forecasting the CPUE. In particular, we used Random Forest as Machine learning technique. Our results are preliminary, both in the temporal data horizon that we are able to explore, and in the broader set of methods that could be employed on this task. We expect that with access to 2017 and 2018 data, the results will improve. On the other hand, other prediction techniques should be exploited as we continue the project.

system level. Intuitively, a decrease of CPUE indicates a situation of over-exploitation, a steady CPUE value points out a sustainable exploitation of the fishery resources and an increase of its value corresponds to a healthy and growing population. CPUE is therefore a key indicator for fisheries management since it could help to define the sustainability of the fishing activities in the area of interest: an accurate forecast of CPUE could help decision makers to obtain a sustainable fishing business by adapting the fisheries management plans on the basis of the forecast results.

Figure 1 illustrates the contributions of our work, that is the proposal of a framework that: (i) integrates the heteroge-

Extracted from:
"Predicting Fishing Effort and Catch Using Semantic Trajectories and Machine Learning"
Pedram Adibi, Fabio Pranovi, Alessandra Raffaeta', Elisabetta
Russo, Claudio Silvestri, Marta Simeoni, Amilcar Soares, and Stan Matwin. Published at Multiple-Aspect Analysis of Semantic Trajectories - First International Workshop, MASTER 2019, Held in Conjunction with ECML-PKDD 2019, Würzburg, Germany, September 16, 2019, Proceedings. Lecture Notes in Computer Science 11889, Springer 2020, ISBN 978-3-030-38080-9

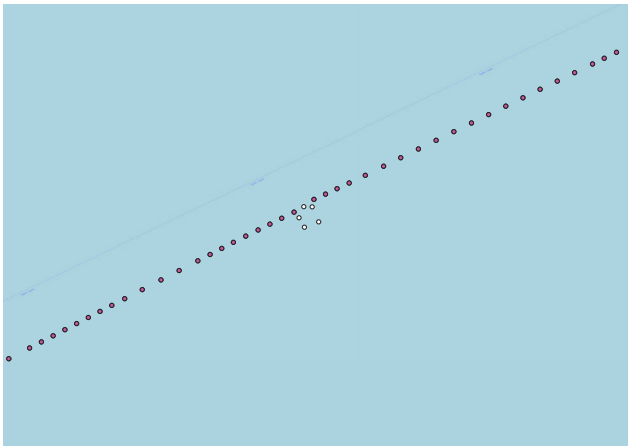
Uncovering hidden concepts from AIS data:

a network abstraction of maritime traffic for anomaly detection

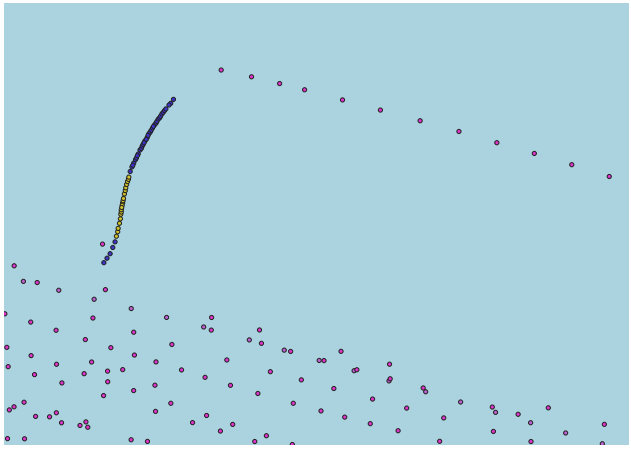
Ioannis Kontopoulos, Iraklis Varlamis, Kostantinos Tserpes, Harokopio University, Athens, Greece

The compulsory use of Automatic Identification System (AIS) for many vessel types, has created new opportunities for maritime surveillance. The analysis of AIS data, may uncover potential illegal behavior, offer real-time alerts and notify the authorities for any kind of anomalous vessel behavior. Towards this direction we investigated trajectory clustering algorithms that group mobility data based on three factors: their difference in speed, heading and distance between the positions.

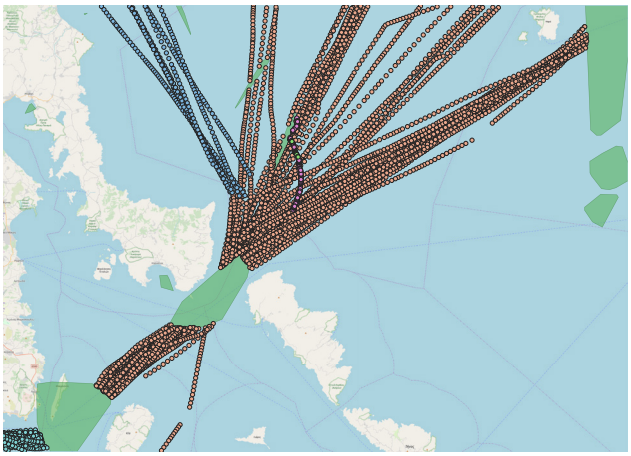
The proposed approach introduces a novel use of a density-based clustering algorithm for AIS positions (i.e. DB-Scan). The result of the algorithm is a set of clusters of AIS positions from multiple vessels. Each cluster indicates different vessel behaviors in terms of speed, heading and distance. The DB-Scan algorithm is applied to AIS data collected from multiple vessels of the same type (e.g., cargo vessels) so that the resulting clusters will be indicative of behavior among the same vessel type. Since dif-



a) Example of an unusual loop in a vessel's trajectory



b) Example of an unusual and steep deviation of a vessel.



c) A trajectory that does not follow the usual maritime traffic has been detected

d) A trajectory that slowly deviates from its course

Figure 1. Outliers detected by the proposed trajectory clustering.

ferent types of vessels vary in size and shape, they may travel at lower speeds or follow different paths. Furthermore, specific vessel types such as cargo vessels might make much more intermediate stops (e.g. in middle sea platforms) than others, resulting in different movement behaviors for different vessel types.

Experimental results on a real dataset show the algorithm's potential for uncovering deviations on a vessel's route, due to its inherent ability to capture movement behaviors. Several cases have been recorded in the past, in which engines fail during a vessel's voyage and the vessel starts drifting away from its normal route. Such small deviations from the normal route cannot be detected by algorithms that seek for major turns or sudden stops. A few outlier cases that have been detected on a real dataset comprising cargo vessels sailing in the Mediterranean sea are depicted in Figure 1.

Figure 1a illustrates a vessel which during its voyage makes a small circle and then continues its journey as before. Figure 1b illustrates the maritime traffic from the west to east. Although several trajectories from multiple vessels are grouped together, the part of the trajectory of a vessel that is headed to the north and deviates from the normal route is considered a different cluster. In two different cases, Figure 1c and Figure 1d visualize the maritime traffic of cargo vessels in two different regions of the Aegean sea. In both Figures, vessels that do not follow the path of the majority are considered as different clusters. In Figure 1c, three clusters are formed i) one that contains the vessel trajectories traveling from the north-east Aegean sea, ii) one that contains vessels traveling from the north-west and iii) a small one inside the larger cluster, which illustrates a deviation of a vessel that does not follow the patterns of all vessels with the same destination. In Figure 1d, in which two clusters are visible, the comparison between the two of them reveals that vessels from the two clusters move at different speeds.

Extracted from:
Uncovering Hidden Concepts from: AIS Data, A Network Abstraction of Maritime Traffic for Anomaly Detection. In International Workshop on Multiple-Aspect Analysis of Semantic Trajectories (pp. 6-20). Springer, Cham.
Kontopoulos, I., Varlamis, I., & Tserpes, K. (2019, September).

Prospective Data Model and Distributed Query Processing

for Mobile Sensing Data Streams

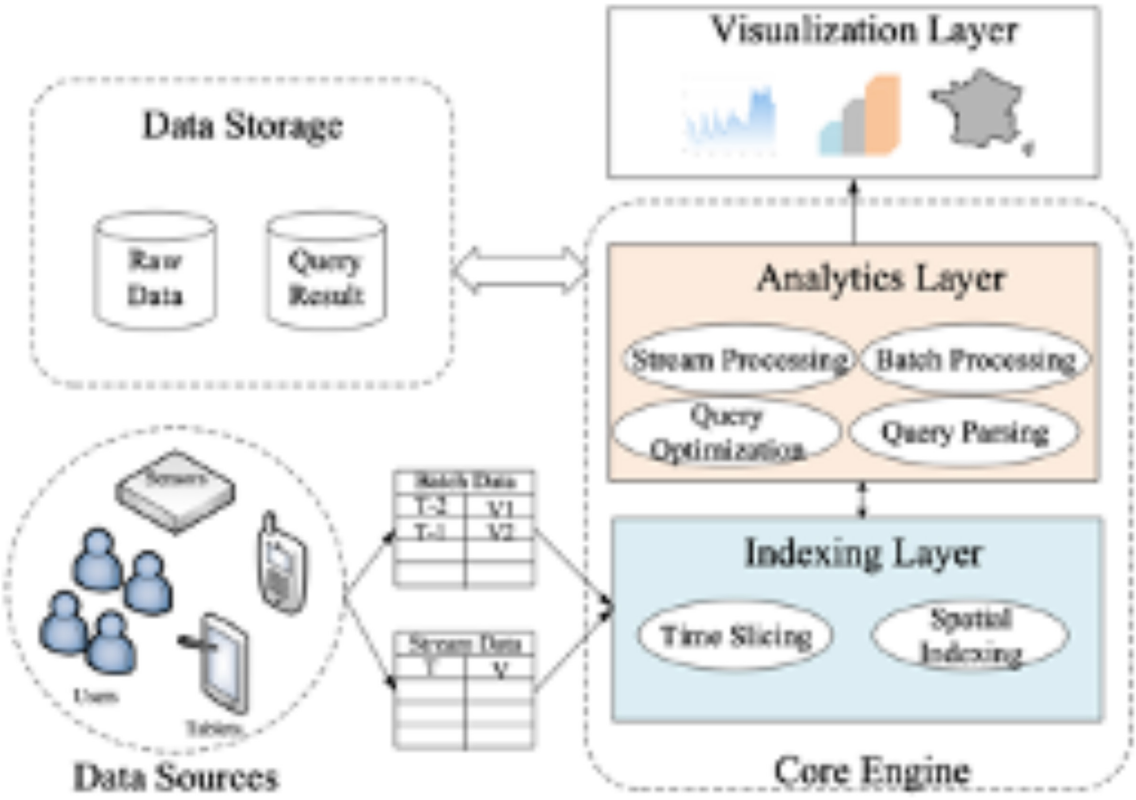
Mariem Brahem, Karine Zeitouni, Laurent Yeh, and Hafsa El Hafyani, DAVID laboratory, UVSQ - Université Paris Saclay, France

With the advent of low-cost and lightweight sensors, Mobile Crowd-Sensing (MCS) has emerged as a new paradigm to collect massive-scale rich trajectory data. Nomadic sensors empower people and objects with the capability of reporting and sharing observations on their state, their behavior and/or their surrounding environments. Processing and analyzing this continuously growing data raise several challenges due not only to their volume, their velocity, and their variety, but also to the gap between raw data samples and the desired application views.

SPECIFICITIES AND CHALLENGES OF STDS MANAGEMENT

Data measured by mobile sensors can be somehow seen as multivariate time series with a spatial dimension. However, they differ from time series by their inherent heterogeneity. Alternatively, we can perceive these data as annotated trajectories. But unlike common scenarios where a few annotations are joint to trajectories, e.g., PoIs, annotations in MCS are much denser, and constitute continuous numerical values. This justifies the design of STDS as a novel model that accounts for the specificities such as:

Data Heterogeneity and Multi-Granularity. The strength of MCS relies on the usage of different types of sensors handsets designed by different manufacturers. The downside is the difficulty of data fusion and their joint analysis, due to the sensor diversity in terms of sensitivity, sampling rate, and noise immunity. Sensors may be offline



The system architecture

for hours, or have different sampling frequencies (e.g., 30 Hz for GPS, and 1 Hz for particulate matters). Therefore, the model should adapt to data incompleteness and multi-granularity.

Spatial and Temporal Autocorrelation. A distinctive aspect of STDSs is the spatial autocorrelation, in addition to the temporal correlation. As a result, collected data from moving objects cannot be modeled as independent data, but observations variations occurring in different locations, or between different periods of time need to be considered as event proxies.

Data Volume and Velocity. Huge amounts of data are being collected continuously from ubiquitous sensor-enhanced mobile devices in different geographical areas. Besides, new rows are typically appended as the data are collected sometimes with a high frequency. Thus, it is necessary to maintain efficient storage structures to handle the velocity of newly arriving data. The commonly used technique in online systems is to consider recent data as more relevant and flush old data. The limitation of such an approach is that historical data are deleted, limiting the opportunities of subsequent analytical processing and mining.

Continuous Queries. Due to the continuous processing of sensor data, spatio-temporal queries should be evaluated continuously, which necessitates an incremental processing paradigm. Traditional approaches for processing spatio-temporal data rely on historical data. While analyzing such archived data is important, it lacks the real-time processing on highly dynamic data. A new system architecture should cover the unique characteristics of sensor data by integrate batch and dynamic processing of massive spatio-temporal data.

PROPOSAL OVERVIEW

We propose a model providing a high-level logical view of spatio-temporal data series (STDSs). To hide the complexity and inhomogeneity of the raw data, queries are expressed on the logical view. To do so, our model captures the different properties of STDSs, such as the granularity and the extent in time and/or space, organized per homogeneous slices. These properties are stored as meta-data, and used by the query engine afterward to interpret the data and optimize the query plan. Another important feature of STDSs in MCS is the velocity. Our system design leverages a distributed framework for micro-batch processing without detriment to query performance. It is under development in the context of Polluscope , a multi-disciplinary project involving eight partners, funded by the French Research Agency ANR.

http://polluscope.uvsq.fr

Secondments

Experiences and results

UNIVERSITY CA' FOSCARI OF VENICE TO DALHOUSIE UNIVERSITY

Prof. Orlando from University Ca' Foscari in Venice (UNIVE) executed a one month secondment to Dalhousie University (DAL), hosted by Prof. Matwin in September 2019. This secondment reinforced the ongoing collaboration on the analysis for AIS dataset of the fishing vessels in the Northern Adriatic Sea. Specifically, researchers of Dalhousie together with Prof. Orlando, have exploited an additional dataset, stating for each vessel (indeed, each fishing company) the fish catches (weights for species) used to semantically annotate trajectories. The dataset includes vessel trajectories ranging from January 2015 until December 2016 (2 years). During the period spent in Halifax, we studied how to further use these enriched trajectories, with also features of the vessel databases, in order to:

(1) Exploit data mining techniques to identify recurrent and seasonal fishing patterns;

(2) Transform trajectory data in a temporal series of graphs, both unipartite and bipartite, where nodes are fishing regions and/or vessels.

The aim is analyzing the temporal evolution of communities (or bi-communities), as well as further measures concerning graphs, and at making predictions exploiting the time series knowledge.

During the secondment Prof. Orlando had the opportunity to meet and network with our partners from Federal University of Santa Catarina (UFSC): Prof. Vania Bogorny, Prof. Luis Otavio Alvares and Luca May Petry who were also visiting Prof. Matwin in a parallel project.

This overlap creates a new collaboration between Canada, Brazil and Italy.

In the picture we see from left to right: Luca May Petry (UFSC), Prof. Orlando (UNIVE), Prof. Stan Matwin (DAL), Prof. Vania Bogorny (UFSC), Prof. Luis Otavio Alvares (UFSC), Amilcar Soares (DAL).

CNR TO FEDERAL UNIVERSITY OF SANTA CATARINA

Three staff members from CNR, Chiara Renso, Raffaele Perego, Beatrice Rapisarda, have been seconded to Federal University of Santa Catarina (UFSC) for one month in October / November 2019, hosted by Prof. Vania Bogorny and her research group.

The focus of these secondments has been manyfold:

the design and implementation of a data access infrastructure to give access to the project Consortium to the many methods and datasets available at UFSC.

Study of similarity and clustering methods for multiple aspects trajectories

Discussion about privacy in multiple aspects trajectories

In the picture below we see Raffaele Perego, Chiara Renso and Beatrice Rapisarda from CNR at the UFSC Department of Computer Science.

HAROKOPIO UNIVERSITY RESEARCHERS TO FEDERAL UNIVERSITY OF SANTA CATARINA

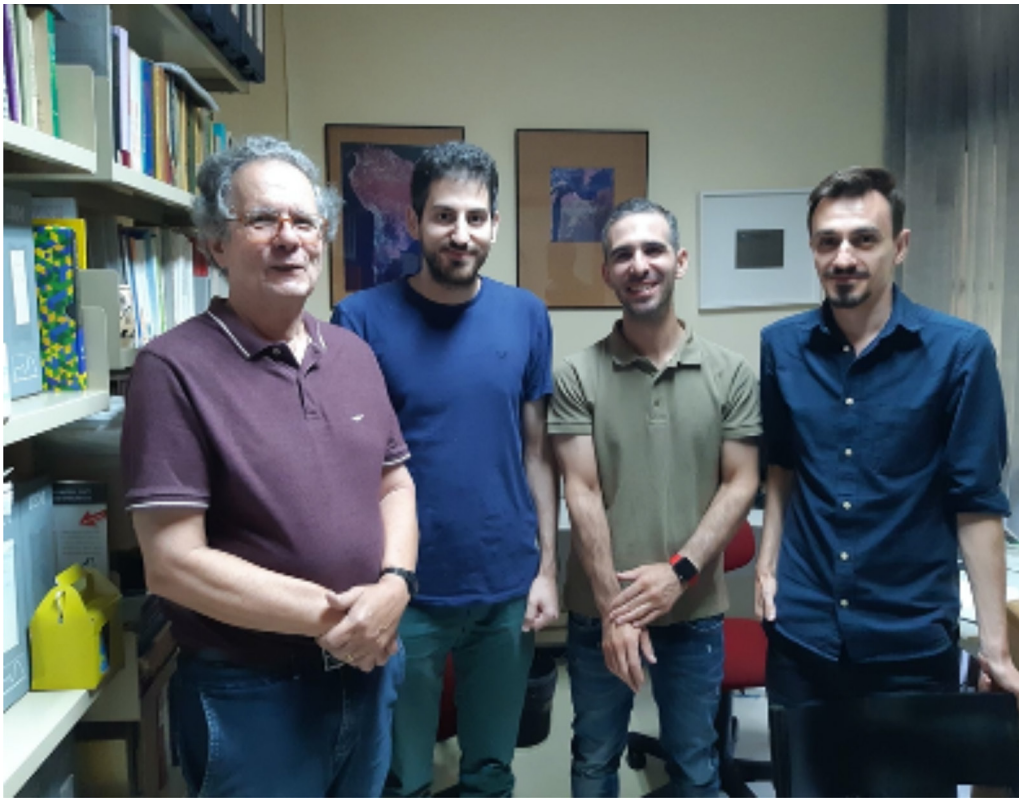
Researchers Irakils Varlamis and Christos Sardianos from Harokopio University have spent one month in Florianopolis, hosted by Prof. Vania Bogorny. Their research activities focussed on Semantic Trajectory classification and Semantic Trajectory clustering where they studied as single-aspect trajectories and designed methods can extend them to multi-aspect trajectories with categorical, ordinal or numeric values, with implied or optional values.

UNIVERSITY OF PIRAEUS TO PONTIFICIAL CATHOLIC UNIVERSITY OF RIO DE JANEIRO

University of Piraeus early stage researchers Nikolaos Koutroumanis, Ioannis Kontoulis, Mario Vontas have been seconded to Pontificial University of Rio de Janeiro (PUC) hosted by Prof. Casanova for one month on November 2019. Their research activities focussed on performance of indexing methods for NoSQl databases, also enriched with textual data and trajectory prediction. In the picture we see from the left to the right Prof. Casanova (PUC), Nikolaos Koutroumanis, Ioannis Kontoulis and Mario Vontas (UPRC).

HAROKOPIO UNIVERSITY TO PONTIFICIAL CATHOLIC UNIVERSITY OF RIO DE JANEIRO

The research activities of Harokopio University researchers during their secondment to Rio de Janiero (Brazil) hosted by Prof. Casanova has been mainly focussed on: (1) identify and categorize the semantic trajectories of two publicly available dataset (Tripbuilder and Foursquare) and their segments so as to be able to translate them in an RDF-triples ontology upon which the algebra that was proposed by Prof. Casanova, to be used in tools to infer the knowledge;



(2) other tasks involved the identification of queries for the evaluation of the approach and the investigation of the extensions of the knowledge representation scheme in big data settings; (3) adaptation of a lightweight ontology introduced by Prof. Casanova, which comprised of some basic semantic operators (“next”, “later”, “always”, “once”) with the objective of reducing the problem to a keyword search which may result in the reduction of the complexity and dimensionality, when dealing with extremely large volumes or high frequency data.

CNR TO FEDERAL UNIVERSITY OF CEARÀ

The secondment of ESR Vinicius Monteiro de Lira (CNR) to Federal University of Ceara’ in Fortaleza (Brazil) lasted one month in December 2019. His secondment fo-

cussed on WP4 and specifically graphs analysis and the problem of influence maximization (IM) that is finding the top-k nodes such that the average infection spread is maximized, under a specific influence propagation model. The idea is to use these methods for analysing vehicles movements represented as graphs.

UNIVERSITY OF PIRAEUS TO DALHOUSIE UNIVERSITY

Prof. Kofidis from University of Piraeus (Greece) executed his secondment of one month to Dalhousie University in Canada during the month of February / March 2020.

The research topic of prof. Kofidis is the application of multi-way arrays (aka tensors) and their (coupled) decomposition to holistic trajectories. These models have been recently shown to outperform more conventional models and methods, and result in highly effective tools for applications such as recommendation and prediction.

RESEARCH VISITS OF OUR PARTNERS

Although they are not formally considered as “official secondments” of the project, some partners have executed research visits in the context of local linked projects. One visit has been executed from a researcher of Federal University of Santa Catarina, Prof. Mello, to Harokopio University in Greece for three weeks in February 2019. The objective of the collaboration is to focus on the MASTER conceptual model for data analytics. Prof. Mello also took the opportunity to visit Prof. Theodoridis and Prof. Pelekis of our partner University of Piraeus. These research visits are an important step to reinforce collaboration among the consortium and start new research lines.

Furthermore, Prof. Vania Bogorny and Prof. Luiz Otavio Alvares from Federal University of Santa Catarina visited Prof. Stan Matwin’s group from Dalhousie University in Canada for three weeks in the period of September / October 2019 in the context of a linked project. Their activities have been focussed on reinforcing the current collaboration lines on trajectory analysis methods.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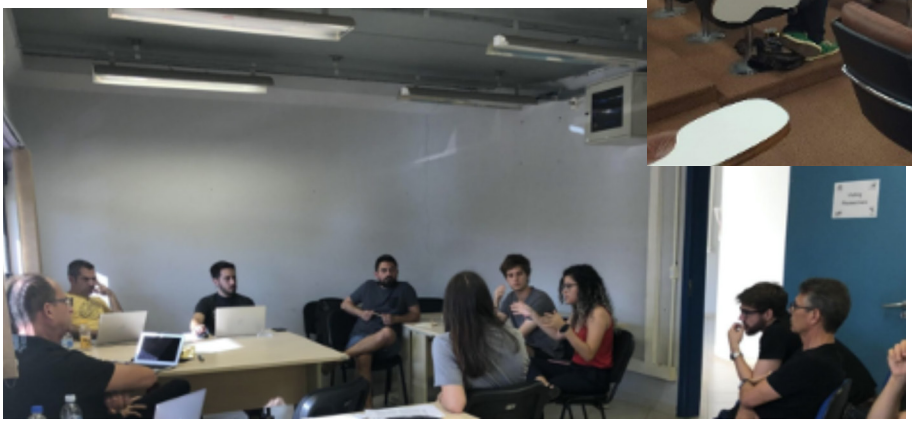

Interviews with secondees

SECONDMENT EXPERIENCE IN THREE WORDS

Collaboration, inspiring, fruitful

Exciting, fruitful, amazing

Collaboration, communication, cultural exchange

Do your best!

Will come back!

Interesting, Thoughtful, Productive

Fruitful, inspiring, productive

New experience, enlightening, creative

Networking, Collaboration and Exchange

Insightful, rewarding, unforgettable

THE MOST APRECIATED ASPECT

Collaboration opportunities

The opportunity to visit a new country and meet people

Being in a new working environment, which allows you to meet new people and learn new things, and opens your mind for new ideas

The collaboration and the opportunity to do research activities in another University

The chance to work in a foreign research environment and meet new people

The chance to live and work in another country for a long time period

The multi-disciplinary collaboration and the 'holistic' way of thinking

The ability to collaborate with scientists from other universities, learn from their experience and the creative time we had together

The networking and exchange of knowledge with students, researchers, and professors that share common research topics

Learning from experienced researchers, coping with their high standards

THE BRING HOME MESSAGE

Experiences like this are the spice of life!

Invest time in yourself to live great experiences that will enrich you

Take every opportunity to meet new people and cultures to enrich yourself

A great research and living experience

Outreach is extremely important for the development of a researcher.

The more you get to collaborate with different researchers from different places, the more open minded your research skills can be. Fantastic experience!

Great experience!

Glad to have done it and should be open to more such possibilities in the future. For sure, a secondment helps broadening your horizon

The secondment experience help PhD's students to develop their skills and grow as scientists

Interdisciplinary works do pay off

Past Events

FIRST MASTER WORKSHOP

Last September 16, 2019 we held the First MASTER workshop. The event has been held joint with the ECML-PKDD conference (https://ecmlpkdd2019.org) in Wurzburg, Germany.
The main conference received an unexpected high number of participants this edition, thus favouring a very good attendance to our Workshop!
The program of the workshop is available at http://www.master-project-h2020.eu/workshop-master-2019/
The formal proceedings has been published by Springer with Open Access financially supported by MASTER, available at
https://link.springer.com/book/10.1007%2F978-3-030-38081-6

We have been very honoured to host the keynote talk by Prof. Yannis Theodoridis. Slides are available at the URL: http://www.master-project-h2020.eu/workshop-master-2019/ the Invited Speaker tab!
We had very good attendance and discussion with MASTER partners and external authors and attendees.

BRIGHT RESEARCHER'S NIGHT

MASTER participated in the Researcher's Night (BRIGHT) at CNR in Pisa and at NTUA in Athens, the night of September 27, 2019.
In Pisa, the project coordinator Chiara Renso introduces the potentialities and issues in the collection and analysis of mobility data. We had a special focus on the analysis of Save and Rescue operations of vessels in the Mediterranean Sea, related to the migration phenomenon.
The talk has been held in Italian for a non specialist audience. Many attendees were citizens interested in better understanding mobility data. Part of the audience was young attendees from schools.
In Athens, at the National Technical University of Athens, Nikos Pelekis and colleagues from our partner UPRC presented MASTER to a wide audience of interested attendees.

MASTER / PRINT JOINT WORKSHOP

The First MASTER – PRINT workshop has been held at the Federal University of Santa Catarina (UFSC) in Brazil.
The PRINT project is an internationalisation project ongoing at UFSC that has several intersections with MASTER topics and partnerships.
We took the opportunity to have 5 secondments at UFSC (3 from CNR and 2 from HUA) to meet altogether with local researchers and share experiences and results to drive our next collaborations.
The workshop took two days, the 11 and 12 of November 2019. You can find the program and the slides at http://www.master-project-h2020.eu/master-print-workshop/

Next Event

ESOF Conference

SEPTEMBER 2-6, 2020

TRIESTE, ITALY

Thanks to the initiative of the EC RISE Unit and our Project Adviser Simona Losmanova, MASTER participates in a cluster of RISE projects (MASTER, INCOGNITO, BEHAPI, SECONDO) who applied for participating in the ESOF Open Forum (https://www.esof.eu/). The application has been accepted for a panel entitled "Network user security and privacy solutions in the new era of artificial intelligence and GDPR". The full program is avaiable at https://www.esof.eu/en/programmes/science-programme.html.
The conference planned to be in Trieste on July 5-9 has been postponed to September 2-6, 2020.

For more info visit:
https://www.esof.eu/en/

Next Event

FIRST INTERNATIONAL SUMMER SCHOOL ON DATA SCIENCE FOR MOBILITY

OCTOBER 12-16, 2020

SANTORINI, GREECE

Massive amounts of spatio-temporal data representing trajectories of moving objects are produced by an ever-increasing number of diverse, real-life applications, ranging from mobile to social media apps and surveillance systems, from vehicle tracking systems to IoT mobile sensors. Such mobility-aware traces come in huge numbers and very complex forms, and can be enriched with multiple different semantic dimensions. These semantically enriched trajectories have the potential to unveil novel challenges in several domains, such as urban, maritime and aviation.

The explosion in Data Science is happening now. The Big Data technological infrastructure has reached maturity. Significant interest from the research community is being shown towards the Big Data Value Analytics reference model: data management, data processing, data analytics, data visualization. The time is right for the field of Mobility Data Science to follow the trend!

Our **First International Summer School on Data Science for Mobility** offers participants both visionary keynote speeches and hands-on mini courses held by leading experts in AI and Data Analytics for Mobility from Canada, Greece & Italy. The keynotes speeches will explore the challenges faced due to the voluminous and complex mobility data generated every day in maritime and aviation domains. The hands-on mini courses complement the keynotes by giving practical experience in the usage of analysis tools on real mobility datasets.

The Summer School was supposed to take place in April 27-May 1, 2020, but due to the coronavirus outbreak the school has been postponed to October.

For updates, please visit:
http://master-school.isti.cnr.it/

Next Event

SECOND MASTER WORKSHOP

JANUARY 2021

VENICE, ITALY

We plan to hold a second MASTER workshop, planned to be in Venice hosted by our partner Alessandra Raffaeta' of University Ca' Foscari of Venice. Originally planned in October 2020, it will be postponed to January 2021 due to the overlap with the postponed MASTER Summer School. The objective of this workshop is to invite (local) stakeholders and present them some of the project results to discuss possible exploitation actions.

To stay up to date about the project news, please visit our website and our blog page

WWW.MASTER-PROJECT-H2020.EU

MASTER

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NEWS

MASTER and the COVID19 pandemic: Privacy at the time of pandemic

April 16, 2020

Prof. Stan Matwin from Dalhousie University reflects on what privacy means in tracking people at the coronavirus time and how the we will balance the tracking and privacy needs in the world ...

Read More

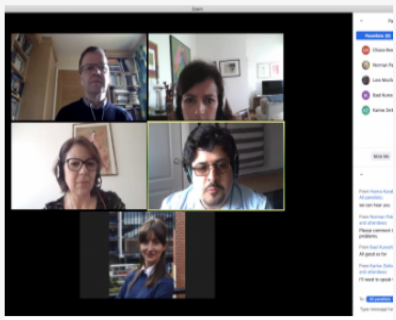
Covid Community Alert

MASTER and the COVID19 pandemic: the COVID App

April 16, 2020

MASTER partners are actively participating and giving contributions to the COVID19 pandemic that is affecting the whole globe.Prof. Vania Bogorny and Luis Otavio Alvares from F...

Read More



Big Mobility Data Analysis workshop held remotely

April 2, 2020

The Big Mobility Data Analysis workshop planned to be in Copenhagen - joint with the EDBT conference - on March 30 has been held remotely, due to the coronavirus restrictions.Chiara Renso (

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DSM

DATA SCIENCE FOR MOBILITY 202

DSM Summer School postponed to October 2020

March 15, 2020

Due to the coronavirus outbreak, the DSM summer school has been postponed to October 2020. For information, check the school web site: http://master-school.isti.cnr.it

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Secondment of Prof. Kofidis (UPRC) at Dalhousie University

March 3, 2020

Prof. Kofidis from University of Piraeus (Greece) executed his secondment to Dalhousie University in Canada during the month of February 2020. The research topic of prof. Kofidis is the appl

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Prof Mello from UFSC visits research group in Piraeus!

February 17, 2020

Prof. Ronaldo Mello from UFSC is visiting Prof. Yannis Theodoridis and Prof. Nikos Pelekis from University of Piraeus (Greece). They discussed how to extend the MASTER conceptual model. I...

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