Scientific Report

First name / Family name	Tiago Veiga
Nationality	Portugal
Name of the *Host Organisation*	NTNU
First Name / family name of the *Scientific Coordinator*	Kerstin Bach
Period of the fellowship	01/01/2020 to 31/10/2020

I – SCIENTIFIC ACTIVITY DURING YOUR FELLOWSHIP

According to the initial plan detailed in the Research Programme, during my fellowship I worked towards decision-making algorithms with air quality monitoring scenarios, with a particular focus on online algorithms for partially observable Markov decision processes (POMDPs), multi-agent communication and reinforcement learning agents for actuation in an urban environment.

In the first topic a novel algorithm based on Monte Carlo Tree Search (MCTS) for POMDPs was developed for information-gathering problems, with a conference paper submitted to AAAI and currently under review.

The second resulted from an international collaboration and resulted in a conference paper accepted at the ROMAN conference. This work combines decision-theoretic algorithms for information gathering with theory of mind concepts to let agents plan ahead what and to whom communicate important observations, without explicit requests from other agents.

Finally, the last topic aims at creating a proof of concept that shows the advantages of using autonomous agents on urban scenarios to control traffic levels and, thus, avoid pollution peaks in crowded areas. I co-supervised a master thesis under this topic which is at the final stage of preparation and is also planned to serve as the basis for a future publication.

In parallel, I was actively involved in the preparation of the IoT pilot of the AI4EU project. I developed a better understanding of the deployment details and participated in the development of the pilot plan which had, as an outcome, the publication of a poster at the IoT 2020 conference. Moreover, I also had the opportunity to study and learn about machine learning techniques for the data gathered from low-cost pollution measuring sensors and contribute to a paper submitted to the AAAI conference on blind calibration of wireless sensor network using deep learning.

II – PUBLICATION(S) DURING YOUR FELLOWSHIP

During the fellowship I participated in a total of 4 paper submissions to international conferences. 2 were accepted (1 as full paper and 1 as poster), while 2 are currently under reviewing:

Accepted:

1. **A Unified Decision-Theoretic Model for Information Gathering and Communication Planning.** Jennifer Renoux, Tiago S. Veiga, Pedro U. Lima and Matthijs T. J. Spaan. International Symposium on Robot and Human Interactive Communication (RO-MAN), 2020.
2. **On the Use of Air Quality Microsensors for Supporting Decision Makers.** Kerstin Bach, Sigmund Akselsen, Tiago Veiga and Ilias Kalamaras. International Conference on the Internet of Things Companion (IoT'20 Companion), Poster, 2020.

Under Review:

1. **An Information Rewarding Approach to Monte Carlo Online POMDPs.** Tiago S. Veiga, Pedro U. Lima, Kerstin Bach. AAAI Conference on Artificial Intelligence (AAAI), 2021.
2. **Deep Learning for Blind Calibration of Wireless Sensor Networks.** Erling Ljunggren, Tiago S. Veiga, Sigmund Akselsen, Kerstin Bach. AAAI Conference on Artificial Intelligence (AAAI), 2021.

III – ATTENDED SEMINARS, WORKHOPS, CONFERENCES

- Gave a talk on the OpenAI Seminar of the Norwegian Open AI Lab (February 21st);
- Gave a talk to the Telenor Research Advanced Analytics and AI team (April 2nd);
- Attended the AAMAS 2020 Conference (online);
- Attended and presented a poster at the IoT 2020 Conference (online).

IV – RESEARCH EXCHANGE PROGRAMME (REP)

There was an initial attempt to schedule a visit at Fraunhofer (Germany) for the first semester of 2020, which had to be postponed due to lack of availability from them to host me. Then, the COVID pandemic hit the world and all plans were cancelled.