
Royal Navy FASTER – Distrusting Artificial Intelligence: Data Scientist

TIN-MOD-001

About the Organisation

This is a unique opportunity to get involved in challenging and unusual problems in submarine operations.

Underwater operations are extremely demanding and full of risk. Passive SONAR is the primary sensor on submarines, silently “listening” for danger hiding in the ocean noise. Submarines must detect before being detected.

This internship contributes to the Royal Navy’s FASTER programme which is rapidly inserting new technology into the heart of submarine systems. FASTER engages with a wide variety of suppliers, from academic subject matter experts to large defence contractors, who provide unusual, radical, new capability to give our submarine crews advantage in the contested oceans.

FASTER has already completed an Alpha release of a submarine management system and is now building a ‘Platform-as-a-Service’ running a skeleton submarine management system, using Agile working practice, to evaluate the provided new capability. This combination of technologies and ways of working gives the Royal Navy a faster, more reliable, way to incorporate technology under its own control and ownership.

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The FASTER programme is sponsored by the Defence Nuclear Organisation and works with Navy Digital Service and Defence Science & Technology Laboratory to deliver new capability into the Submarine Delivery Agency Innovation Hub.

Role Description and Responsibilities

While Artificial Intelligence can contribute extraordinary capabilities, badly trained AIs can be worse than useless. There are several efforts to evaluate how well an AI has been trained, based on examining the training sets and outcomes of test set applications. Some of these can also be used to assure the initial training sets are suitable.

Your role will be to:

- Review the literature on existing ways of evaluating AI.
- Select and implement at least one as an assurance analysis.
- Select and gather suitable data sets.
- Write a software service that can examine an AI service using a suitable range of test

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data and produce a report about its trustworthiness.

You will join a team of expert software engineers, developers, data scientists, technical architects, business developers and Royal Navy personnel delivering the FASTER programme.

You will be independent, energetic, resourceful, and good at explaining complicated concepts to a non-expert audience. As part of your role, you will transfer knowledge of data science techniques and machine learning to the wider FASTER team.

We are an Agile team, and you will be expected to attend regular Stand ups, and update meetings with team members and contribute towards current Sprint goals.

Expected Outcomes

- A literature review of rigorous processes that could be applied to assure platform safety when exploiting AI (ML) based processing.
- Implementation of an AI evaluation using a test data set for assurance analysis of the algorithm.
- An AI evaluation software service app.

By the end of the project, you will have a good grasp of the training characteristics required for AI systems, experience in assuring AIs and you will have delivered an important component that supports the FASTER programme's evaluation of AI capability.

Supervision and Mentorship

You will be a self-starter with the ability to work both independently and part of a multi-disciplinary team.

You will be mentored by the FASTER data lead and the technical architect both of whom will provide you with the necessary detailed background to the problem, support you and review your work.

Person Specification

Someone who enjoys a challenge and is keen to develop on existing knowledge and deliver quality outputs.

The successful candidate will have strong data scientist skills:

- Ability to code in Python and familiarity with Anaconda, MATLAB, or R (essential).
- Understanding of basic machine learning (or AI) assurance inclusive of the role of data quality (essential).
- Good skills in visual data representation (essential).
- Understanding and knowledge of standards in AI assurance and safety (desirable).

Internship Logistics

Start date: January 2023

Salary: £30,000 per annum pro rata

Internship duration: 3-6 months full-time (We regret that we are unable to consider part time applications)

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Location: Hybrid of remote working and on-site in Portsmouth area / Leighton Buzzard / London.

PoC: Dr Andrea Day (andrea.day131@mod.gov.uk)

Security clearance: Candidates will need to obtain Baseline Personnel Security Standard (BPSS) clearance as a minimum. This will be sponsored by the contracting organisation.

Nationality: Prospective candidates must be UK nationals.

The successful candidate will be contracted by Digi2al Limited on behalf of the MoD.

Royal Navy FASTER – Uncertainty In Automatic Reasoning: Data Scientist

TIN-MOD-002

About the Organisation

This is a unique opportunity to get involved in challenging and unusual problems in submarine operations.

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Role Description and Responsibilities

Underwater situational awareness is built from data that is sparse, unreliable and cluttered. The operating picture is assembled from data elements that have been calculated from a chain of inferences from variously uncertain measurements. Artificial Intelligence systems that contribute to such inferences need a way to describe and model uncertainty, so that they propagate it through their reasoning chain.

This task is to solve this problem in the object classification elements of the submarine management system. Properties of an object are inferred from features in the sonar data, and this is then used to infer the type of vessel, which in turn is used to infer its likely behaviour. Each of these inferences carries an uncertainty which should be suitably propagated and modified accordingly when fused with other uncertain data.

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Your role will be to:

- Review the literature on existing uncertainty modelling.
- Create a formal data model to associate uncertainty with qualitative and quantitative data, including positions.
- Create a propagation model when fusing data.
- Implement a data fusion service, for example for target classification in the FASTER Combat Management System, that implements the data and propagation models.

You will join a team of expert software engineers, developers, data scientists, technical architects, business developers and Royal Navy personnel delivering the FASTER programme.

You will be independent, energetic, resourceful, and good at explaining complicated concepts to a non-expert audience. As part of your role, you will transfer knowledge of data science techniques and machine learning to the wider FASTER team.

We are an Agile team, and you will be expected to attend regular Stand ups, and update meetings with team members and contribute towards current Sprint goals.

Expected Outcomes

- A literature review on existing uncertainty modelling.
- Alpha models for the propagation of uncertainty in the reasoning chain.
- A formal data model to associate uncertainty with qualitative and quantitative data.
- Fused data service implementing uncertainty propagation model and underlying data.

By the end of the project, you will have a good grasp of practical uncertainty in Navy subsurface encounters, experience in data modelling and data fusion, and you will have delivered an important component that supports the FASTER programme's evaluation of AI capability.

Supervision and Mentorship

You will be a self-starter with the ability to work both independently and part of a multi-disciplinary team.

You will be mentored by the FASTER data lead and the technical architect both of whom will provide you with the necessary detailed background to the problem, support you and review your work.

Person Specification

The ideal intern is someone who enjoys a challenge and is keen to develop on existing knowledge and deliver quality outputs.

- The successful candidate will have strong data scientist skills:
- Ability to code in Python and familiarity with Anaconda, MATLAB or R (essential).
- Good understanding of statistical uncertainty (essential).
- Experience in software implementation (essential).

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- Good skills in visual data representation (essential).
- Experience in data fusion specifically fusing visual data with machine learning algorithms (desirable).

Internship Logistics

Start date: January 2023.

Salary: £30,000 pro rata.

Internship duration: 3-6 months full-time (We regret that we are unable to consider part time applications).

Location: Hybrid of remote working and on-site in Portsmouth area / Leighton Buzzard / London.

PoC: Dr Andrea Day (andrea.day131@mod.gov.uk).

Security clearance: Candidates will need to obtain Baseline Personnel Security Standard (BPSS) clearance as a minimum. This will be sponsored by the contracting organisation.

Nationality: Prospective candidates must be UK nationals.

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Royal Navy FASTER – Underwater Data Scientist

TIN-MOD-003

About the Organisation

This is a unique opportunity to get involved in challenging and unusual problems in submarine operations.

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Role Description and Responsibilities

Your role will be to evaluate the supplied capabilities, we will run them through a range of real - and realistically simulated – scenarios. Submarine crews understand the world around them by listening using hydrophones (underwater microphones), so these scenarios are driven using historic acoustic hydrophone data recorded by various academic, commercial and defence organisations.

This data has often been poorly formatted and maintained. We will acquire the data, and your role will be to:

- Examine it, extract the right parts of it, transform it into consistent modern forms and formats, and load it onto both RDBMSs and no-SQL warehouses.
- Clean, normalise and extract subsets.
- Document the new formats.
- Write software plugins to play back the data into the combat management systems.

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- Label the data with features discovered within it.

You will join a team of expert software engineers, developers, data scientists, technical architects, business developers and Royal Navy personnel delivering the FASTER programme.

You will be independent, energetic, resourceful, and good at explaining complicated concepts to a non-expert audience. As part of your role, you will transfer knowledge of data science techniques and machine learning to the wider FASTER team.

We are an Agile team, and you will be expected to attend regular Stand ups, and update meetings with team members and contribute towards current Sprint goals.

Expected Outcomes

To provide datasets which are ready to use in the FASTER programme, by the supplier community, to test machine learning algorithms and new CMS capabilities:

- Curated underwater datasets
- Software plugins for use in the combat management systems
- Labelled sonar data
- Revisions to the FASTER sonar labelling tool.

By the end of the project, you will have experience in real-world data transfer, skills in both relational databases and non-relational warehouses, and you will have delivered an important component to the FASTER programme and community.

Supervision and Mentorship

You will be a self-starter with the ability to work both independently and part of a multi-disciplinary team.

You will be mentored by the FASTER data lead and the technical architect both of whom will provide you with the necessary detailed background to the problem, support you and review your work.

Person Specification

Someone who enjoys a challenge and is keen to develop on existing knowledge and deliver quality outputs.

The successful candidate will have strong data scientist skills:

- Ability to work with a variety of data sources and data analyst tools e.g., SQL, Python, and Jupyter Notebooks.
- Familiarity with Anaconda, MATLAB, and/or R.
- Experience with big data, and time series data would be an advantage.
- Ability to use and update noSQL databases.
- Data wrangling, data cataloguing/labelling, and data quality checks.

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