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## Accenture – Graph Machine Learning for Healthcare

TIN-ACC-018

### About the Organisation

Accenture Labs are Accenture's dedicated arm of research and development. We focus on solving critical business problems with advanced technology, bringing fresh insights and innovations to our clients, helping them capitalize on dramatic changes in technology, business, and society. Our dedicated team of technologists and researchers work with leaders across the company to invest in, incubate and deliver breakthrough ideas and solutions that help our clients create new sources of business advantage.

At Accenture Labs Dublin, based at The Dock, we focus on Artificial Intelligence methods such as explainable AI, graph machine learning, and generative models applied to business areas as diverse as healthcare, life science, workforce, supply chain and consumer products.

### Role Description and Responsibilities

**Project Title:** Graph Machine Learning for Healthcare

**Analysis Methods:** Deep Learning, Knowledge Graphs, Graph Machine Learning

**Broader Objectives:** design graph machine learning models to infer complex relations from biomedical knowledge graphs.

**Internship Description:** Recent advances such as Graph Neural Networks and Knowledge Graph Embeddings have been used successfully to predict missing, unseen edges in large graph databases [1,2,3]. Accenture Labs adopt them in client and research projects for drug discovery, oncology decision-support, and clinical research hypothesis verification.

Despite an excellent trade-off between predictive power and scalability, many aspects of these architectures are still under research scrutiny. Graph machine learning research directions include supporting multi-hop complex reasoning, time-awareness, learning in an incremental fashion or with few examples, leveraging multi-modal data, ensuring human interpretability, uncertainty quantification, just to name a few [5,6]. An area of significant interest is the interplay with large (biomedical) language models, to refine output generation with the help of structured graph information.

The research intern will join a precision medicine project and will be in charge of designing, implementing, and evaluating novel principled ways to tackle one or more research problems listed above, with the ultimate goal of inferring knowledge from incomplete clinical and genomic knowledge graphs. The intern is expected to explore and experiment with a range of techniques from prior art, propose original research, and implement ideas that will be validated with the research team in Accenture Labs Dublin.

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**Data Source:** Accenture's large dataset of structured real-world clinical records. Publicly available datasets on population-level multi-omics data (genomic, biological pathways, diseases, drugs, etc).

### Expected Outcomes

Software prototype, technical report, submission to major AI academic conference (open publication policy), opportunity to contribute to our open-sourced graph machine learning library [4].

[1] <https://kge-tutorial-ecai2020.github.io/>

[2] [https://www.cs.mcgill.ca/~wlh/grl\\_book/](https://www.cs.mcgill.ca/~wlh/grl_book/)

[3] <https://arxiv.org/abs/2004.14843>

[4] <https://github.com/Accenture/AmpliGraph>

[5] <https://arxiv.org/abs/2012.05876>

[6] <https://arxiv.org/abs/2011.03459>

### Supervision and Mentorship Arrangements

The internship will **\*not\*** be remote and requires relocation to Dublin, Ireland. On-site supervision by Luca Costabello and other members of the research team in Accenture Labs Dublin.

### Person Specification

#### Key Requirements

- Being enrolled in a PhD program in Computer Science
- Strong knowledge of Machine Learning foundations and mainstream Deep Learning architectures
- Strong scientific Python programming skills (e.g. NumPy)
- Hands-on experience with at least one machine learning framework (e.g. TensorFlow, PyTorch, JAX)
- Ability to work creatively and analytically in a problem-solving environment
- Excellent verbal and written communication in English
- Ability to pause your PhD for the duration of the internship and return subsequently

#### Optional

- Previous exposure to **\*at least one\*** of these areas: Machine Learning for Knowledge Graphs (e.g. Knowledge Graph Embeddings), Graph Neural Networks, GNN architectures, Graph ML for Natural Language Processing, Self-supervised Learning on Graphs, Interpretable and Trustworthy Graph ML
- Previous exposure to Healthcare and Precision Medicine projects
- Familiarity with genomics and precision medicine foundations

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### Application Procedure

Please apply via the application form on Flexigrant. In the form, please ensure to include any relevant links to illustrate programming experience (e.g. GitHub handle) and scientific accomplishments (e.g. Google Scholar, dblp, arXiv links, personal homepage).

### Internship Logistics

This internship will be based in Accenture, Dublin - The Dock, 7 Hanover Quay

The start date is expected to be January/February 2023.

The duration will be 6 months.

The remuneration will be pro-rated, based on an equivalent annual salary of €40k.

This is a full-time position, and we regret that we are unable to consider part-time applications. Only students who are UK nationals or possess the Right to Work full time in the Republic of Ireland are eligible to apply.

*\*\* If appointed the candidate will be required to complete a background check. The following documents will be required for the check: passport or another form of governmental ID, address history, academic/employer history, referee details.*

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## Accenture – Algorithmic Bias and Neutrality

TIN-ACC-019

### About the Organisation

Accenture's **Responsible AI practice** sits within the wider multidisciplinary Applied Intelligence team of experts across a range of academic and industry backgrounds. The advances in artificial intelligence, machine learning and use of data are creating unprecedented opportunities for society and our clients to benefit. The transformation has already begun with AI driving much of our day to day lives, and we expect the rate of innovation in AI to only accelerate. The positive opportunities AI affords also contrast with significant risks that can arise from the inappropriate use of AI. It is critical to understand the range of harms and risks to citizens and society from AI, and to develop approaches that allow AI technologies to be used responsibly, ethically, and lawfully. The Responsible AI group in Accenture is leading Accenture's efforts to ensure all AI development and use is Responsible by design. Our goal is to ensure citizens, our clients, regulators, and practitioners can benefit from Accenture's expertise in making being Responsible simple.

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### Role Description and Responsibilities

#### Project Title: Algorithmic Bias and Neutrality

Accenture Labs and Accenture's Responsible AI Practice are jointly collaborating on a project on Algorithmic Bias and Neutrality with the Oxford Institute for Ethics in AI. We have an opening for an intern to work as part of the project for 6 months. Below is the background and context of the project followed by the specific opportunity for this internship.

#### Background and Context

The story is bleak and familiar: bias infects the algorithms that increasingly govern our lives. What, though, is this bias? While we know it when we see it, algorithmic bias has escaped systematic philosophical investigation. The Institute for Ethics in AI's Milo Phillips-Brown in collaboration with Accenture Responsible AI and Labs teams, is undertaking such an investigation.

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His starting insight is that when something – algorithm or otherwise – is biased, it is biased relative to some baseline. For example, the New York Times is accused of liberal bias, the allegation is that the Times skews away from a baseline of an even mix of liberal and conservative viewpoints. When the Times is accused of bias against Bernie Sanders, the allegation is about a different baseline, one of an even mix of coverage between Sanders and other Democratic candidates. Different baselines, different (alleged) biases.

An algorithm can similarly be assessed for bias relative to any different number of baselines: which baseline we use profoundly affects how we respond to bias. Relative to one baseline, the response is to make the algorithm perform better at its intended goal; relative to another, the response is to operationalize that goal differently; relative to other baselines still, the response is to pick a different goal entirely.

**How does an entity determine if an AI system is biased relative to their internal values and also market expectations? How do they pick the baseline, measure against it, and determine if they are getting an acceptable outcome? How do they do this at the right point in the development cycle?**

### Project

The first step of this project is theoretical and will be complete when the intern joins: applying a rigorous philosophical method to develop an approach to determine baselines against which bias can be measured.

The second, applied research, phase of the project is where the intern will focus - putting this theoretical approach into practice. Specifically, developing a technical prototype to enable applying this theoretical approach for a specific use case. The aim is by developing a step-by-step method, we will enable practitioners to understand algorithmic bias and neutrality in terms of baselines; how to identify the baselines, and corresponding biases, relevant to their own technologies; and how to respond to those biases.

The research intern will join the project team and will be in charge of designing, developing, implementing, and evaluating the outcomes of, the working prototype. There is an ultimate longer-term goal (post the internship) of using this prototype to of enable the creation a toolset that can used by industry to answer the questions bolded above.

### Expected Outcomes

- Software prototype: a working prototype of the method developed that can be demoed – a proof of concept in simplified setting which will showcase benefits and functionality
- Technical report
- Research paper, co-authored by Milo, the Intern and Accenture PIs to be submitted to an AI academic conference (open publication policy)

### Supervision and Mentorship

This role will be co-supervised – main supervisor would be academic PI; Milo Philips-Brown at the Oxford Inst of Ethics and AI and the supporting business PIs will come from Medb Corcoran, Managing Director of Accenture Labs Dublin and Ray Eitel-Porter, Global RAI lead

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at Accenture.

### Person Specification

The Ideal Intern will have:

- A demonstrable passion for Responsible AI
- Strong academic background in computer science
- Interest in solving real-world scientific problems and in acquiring commercial awareness
- Ability to pause their PhD for the duration of the internship and to return to their studies upon completion

### Internship Logistics

This internship would ideally be based in Oxford for proximity to academic PI but could also be based in Accenture's UK HQ in Fenchurch Street, London, Accenture Labs in Dublin, Ireland, depending on what works best for the candidate.

The start date will be January 2023 and the duration will be 6 months.

The remuneration will be pro-rated based on an equivalent annual salary of £33.5k.

This is a full-time position, and we regret that we are unable to consider part-time applications.