2019 Application Form

Deadline – 12pm, Tues 12th March 2019

Guidance on completing this form is available as a separate download, available here: https://www.sheffield.ac.uk/sure/301

Applicant Details

Student Name Sebastian Ksiazczyk	Supervisor Name Rob Gaizauskas
Student Department Department of Computer Science	Supervisor Department Department of Computer Science
Email address sksiazczyk1@sheffield.ac.uk	Email address r.gaizauskas@sheffield.ac.uk
Current year of study: (please indicate by placing an X in the relevant box) Year 2 (of a 3 year course) ☐ Year 2 (of a 4 year course) ☐ Year 3 (of a 4 year course) X *NB*: We can't accept applications if you're in your first or final year of study	Second Supervisor name and email (optional):

Project Proposal

Title

Metaphor interpretation based on weighted abduction in Markov Logic Networks

Outline (500 words max)

Metaphor is an inherent characteristic of all natural languages that helps us relate abstract concepts to domains most familiar to us, e.g. spatial orientation. Conceptual metaphor theory represents this device as understanding of a concept through referring to properties of another concept e.g. "Smith ran circles around Jones in the debate this afternoon".
Metaphor interpretation is one of the big challenges in Natural Language Processing (NLP). Although humans have developed a natural ability to reason metaphorically (in fact, research suggests that we are as efficient in metaphorical communication as we are in literal), this is not the case for computers. In NLP, metaphorical expressions add the problem of recognizing and interpreting figurative speech onto the already existing problem of interpreting discourse where only literal (basic) meaning of words is considered. As a crucial step towards text interpretation, an efficient method of automatic processing of metaphors would have a significant impact on the IT industry, in particular in automatic translators, voice assistants and chatbots.

Abduction is inference to the best explanation. For the last 30 years it has been a hot topic in NLP, considered by many a promising scheme for interpretation systems. Weighted abduction (a variant in which weights are applied to terms) helps an interpreter link newly acquired information against what she already knows and decide which among many explanations is the best (most probable).
Abductive inference is a good way of thinking about MI. In the example:
'Ann and I are going nowhere.'
There are two domains used in the metaphor: "love" and "journey". Being in a relationship is compared to being on the road, the lovers - to travellers. The task for an MI system would be to identify these domains and relations. Abductive inference would do that by finding the most probable mapping of the given metaphor within a knowledge base.
Over the years there have been multiple attempts at building abduction engines (AEs) for various problems in NLP, including metaphor interpretation, but the most promising AE has not yet been applied to the problem, namely an engine employing Markov Logic Networks.
Markov Logic Networks are a framework which merges first order logic and probability into one representation, thus allowing for efficient reasoning on logically represented data under uncertainty.
My aim in this project would be to implement a metaphor interpretation system that uses weighted abduction, and is based on an MLN abduction engine, which I consider to be theoretically best among AEs for this particular task. This would build on my dissertation work where a basic AE in MLNs has already been implemented. Once the system is complete, I wish to compare its effectiveness with other MI systems identified in research.
If the project is successful, the outcome could be a publication about the discoveries and a prototype of a theoretically sound MI system.

Start date (please indicate by placing an 'X' in the relevant box)

The majority of projects will commence on Mon 10 June 2019. You may request a different start date below, but please be aware that **projects cannot start before Monday 10 June 2019.**

Monday 10 June 2019 X

Other ☐ (please state date and reason):

End Date (please indicate by placing an 'X' in the relevant box)

The majority of projects will finish after a 6-week period on Fri 19 July 2019. You may request a different end date, but please be aware that **projects must be completed by Friday 9 August 2019.**

Friday 19 July 2019 X

Other ☐ (please state date and reason)

Milestones and targets (you may wish to organise these into weekly aims)

EO Week 1: Research material has been identified and organised.
EO Week 2: All researched material has been analysed and reviewed.
EO Week 3: System has been implemented.
EO Week 4: System has been tested, results compared.
EO Week 5: Draft version of paper finished and delivered to Supervisor.
EO Week 6: Final version of the paper has been finished.

Supporting Information - Student
(please refer to guidance notes before completing)

1. Student's statement of interest in the project and their suitability

As I was reviewing literature for my dissertation project, I stumbled upon several captivating papers about discourse interpretation theories and tools. I immediately knew that I wished to continue working in the area when my dissertation was finished.
I am now convinced that I have substantial foundational knowledge in the area coming from both literature reviewed in my third academic year and some extra-curricular material I have read (books describing linguistic theories), and owing to these I am suitable to commence a project about the topic I have chosen.
Because my dissertation project was research-oriented, I can say I have experience in delivering such projects, which includes the ability to efficiently utilize library materials, think critically about newly acquired knowledge and reporting advancements to my Supervisor on a regular basis.
Under the eye of my Supervisor with whom I have successfully worked throughout my 3rd year of study, I am positive I can produce something of great quality and potential use in academia and industry.

2. Student's statement on anticipated future impact of taking part in SURE

The work I have undertaken in the process of writing my dissertation paper has been by far the most fascinating journey on the path of my academic growth.
I was already fascinated with Natural Language Processing where I arrived in Sheffield to begin studying Artificial Intelligence, and ever since the passion has only been strengthening thanks to interesting assignments and lectures provided in my course.
The opportunity to conduct my own research and potentially publish a paper would make a significant difference not only to my academic growth, but potentially my career choices. It is at the moment the greatest chance for me to see what work in research consists of.

Supporting Information - Supervisor
(please refer to guidance notes before completing)

1. Supervisor's statement regarding relevance of the research

Metaphor interpretation is indeed a fundamental human linguistic capability and one that is very difficult to model in computational language processing systems. It is an acknowledged big, open question in Natural Language Processing, and one that any progress towards solving would mark a significant advance in the field, with tremendous potential for improving the host of language technology applications that are appearing all around us. The research that Sebastian is proposing to carry out is state-of-the-art and, while it is too much to expect that he will solve a big, open question in the field, his work could give crucial insights into which directions forward will prove to be worth following and why. It is highly relevant research that will not only advance his understanding and potentially affect his career choices (e.g. whether he continues on to post-graduate research) but will have a positive impact on my understanding and in the capabilities of our lab to do research in this area (i.e. in terms of computational tools and infrastructure).

2. Supervisor's statement regarding student's aptitude, ability and interest in project

Sebastian is an extremely able and hard-working student (solid 1st class average across his first two years here) who has that rare combination (in Computer Science undergraduates) of

intellectual passion and ability for the more abstract/theoretical sides of computer science and artificial intelligence together with the solid programming and practical side of CS which is necessary to build stuff that works. Given this background and his solid progress on his dissertation project to date, which is on a closely related topic, I have every confidence in his aptitude and ability to carry out this project. Regarding his interest in the project, he is the one who approached me with the idea for the project and wish to do it. His interest was aroused by extracurricular reading that he has carried out and by his joining the dots between several related areas of research – again something unusual in our undergraduate community. I have no doubt that his interest in the project is genuine and very deep.

3. Clear indication of Supervisor arrangements

The student will be given a desk for the duration of the project in the PhD lab associated with the Supervisor's research group and in close proximity to the Supervisor's office. He will also be given access to the research computing facilities made available to PhD students, both within the Department and CiCs, as necessary. The supervisor, who will be in Sheffield for the entire duration of the project, will meet with the student formally at least once per week, to review progress towards aims in the work plan and revise the plan or deal with any problems arising. However, the supervisor will be available on an ad hoc basis as well. The topic area of this research is close to the Supervisor's own core research interests and his close involvement in the project can be guaranteed.

Dissemination Plan

Please state how the outcomes of your project will be disseminated at the SURE Showcase event, as well as in/or beyond your department and the University of Sheffield.

For the SURE Showcase a poster with graphics explaining the method used for metaphor interpretation could be prepared, as well as depictions of the results achieved with the method (with transparent test cases). If possible, a demo of the system could be available to run on a laptop, and with its help I could explain to the interested the concepts behind it.
The implemented system will remain available for Supervisor's use and could be re-used for example as the basis for a future undergraduate project.
Because the planned outcome of the project includes a published paper, that publication will help disseminate the conducted research beyond the University of Sheffield. To reach potentially interested scientists within the NLP community, this paper could be shared on social media groups such as LinkedIn group for NLP researchers.

Bursary Requirements

Please state the total amount of bursary funding required for your project.

£1080 X

Other ☐ (please state amount and reason)

Are there any additional costs associated with your project? If so, please provide an itemised list of expenses up to a maximum of £150 (£500 for lab-based projects).

Ethics

I am aware that, should my project require ethics approval, my departmental procedures should be followed, and the SURE team cannot obtain ethical approval on my behalf. (please indicate by placing an 'X' in the relevant box)

Yes X

Completed forms should be uploaded via the SURE 2019 Google application form, available here: https://www.sheffield.ac.uk/sure/301

Due to the anticipated large number of applications, late submissions will not be considered.