Programme Specification

A statement of the knowledge, understanding and skills that underpin a taught programme of study leading to an award from The University of Sheffield

1	**Programme Title**	Computer Science with Speech and Natural Language Processing
2	**Programme Code**	COMT127
3	**HECoS Code**	100961
4	**Level of Study**	Postgraduate
5a	**Final Qualification**	MSc
5b	**Position in the QAA Framework for Higher Education Qualifications**	M Level
6a	**Intermediate Qualification(s)**	Postgraduate Diploma (PGDip), Postgraduate Certificate (PGCert)
6b	**Position in the QAA Framework for Higher Education Qualifications**	Masters' Level
7	**Teaching Institution** (if not Sheffield)	Not applicable
8	**Faculty**	Engineering
9	**School**	Computer Science
10	**Other School(s) involved in teaching the programme**	None
11	**Mode(s) of Attendance**	Full-time
12	**Duration of the Programme**	1 year
13	**Accrediting Professional or Statutory Body**	British Computer Society
14	**Date of production/revision**	November 2023

15. Background to the programme and subject area

Recent years have seen a substantial growth in the capabilities of Speech and Natural Language Processing (SNLP), both in the research laboratory and in the commercial marketplace, and the relevant research and development has reached a point where a significant return on investment is being derived from the deployment of large-scale commercial applications. Large vocabulary continuous speech recognition is now available 'off-the-shelf' at low cost and spoken language dialogue systems are becoming a familiar feature of telephone-based and other media-based IVR (interactive voice response) systems.

As a result, there is strong demand for graduates with the highly specialised multi-disciplinary skills that are required in SNLP, both as practitioners in the development of SNLP applications and as researchers into the advanced capabilities required for next-generation SNLP systems. The MSc in Computer Science with Speech and Natural Language Processing has been carefully tailored to meet this training need, by providing a balanced programme of instruction across a range of relevant disciplines. The School of Computer Science is an internationally recognised centre for SNLP research, with particular interests in the fields of speech technology, natural language processing and dialogue systems. The School has an international reputation for the quality of its research. In the 2021 Research Excellence Framework (REF), 99% of our research was rated in the top two categories, meaning it is classed as world-leading or internationally excellent. The School is rated 8th nationally for the quality of our research environment. The programme is accredited by the British Computer Society (BCS), as fully meeting the educational requirements for CITP Further Learning, and partially meeting the educational requirements for CEng and CSci registration.

Students on the MSc in Computer Science with Speech and Natural Language Processing will directly benefit from the research-led environment in which this programme is taught. In the context of the MSc programme, this means that students are taught the most advanced theories and techniques in the field, and also have the opportunity to use state-of-the-art software tools. Students have further opportunities to engage in research-level activity through in-depth exploration of chosen topics and in the completion of a dissertation. As a result, students graduating with this degree will be highly valued in industry, commerce and academia. In addition, the

programme acts as an excellent introduction to the substantial research opportunities for potential doctoral-level study in the SNLP field.

See the School of Computer Science website: http://www.sheffield.ac.uk/dcs for more information.

16. Programme aims

A1 To provide a high-quality programme, which is at Masters' level and may be successfully completed by graduates of disciplines other than Computer Science (as provided for in the CPHC/QAA Benchmarking Standard for Masters' Degree in Computing).

A2 To focus in depth on issues relevant to current theoretical and practical aspects of Speech and Natural Language Processing, and to set these in the context of key topics in speech processing, text processing and machine learning.

A3 To develop skills for the critical evaluation of new developments in the field of Speech and Natural Language Processing.

A4 To provide immediately employable graduates who are able to deal with complex and unpredictable situations in a systematic and creative way.

A5 To educate within an environment that is underpinned and inspired by the research attainment and scholarship of staff.

17. Programme learning outcomes

Knowledge and understanding:	
Masters' and Diploma students will have developed:	
K1	Sound knowledge and critical understanding of gathering, organising, and evaluating information needed to formulate and solve problems.
K2	Sound knowledge of techniques for computer processing of speech and text.
K3	Sound knowledge of techniques for learning from data, and the application of these techniques in the field of human language processing.
K4	Deep knowledge and critical understanding of recent developments in Speech and Natural Language Processing, including those relating to automatic speech recognition, natural language processing, dialogue systems and computational hearing.
***In addition, students achieving a Masters' will have*:**	
K5	Deep knowledge and critical understanding within the specific subject area of the MSc project and dissertation.

Skills and other attributes:	
Masters' and Diploma students will have developed:	
S1	The ability to function in a computer-based learning environment, making full use of email, the internet and electronic media.
S2	The ability to engineer a human language processing application in a rigorous and principled manner, through processes of analysis, design, implementation and evaluation.
S3	The ability to critically evaluate and select software tools appropriate for building particular Speech and Natural Language Processing applications.
S4	Written communication skills, including the ability to summarise and present coherently an argument, the ability to expose technical information systematically and clearly, the ability to comprehend, summarise, synthesize and properly cite material as part of an integrated argument.
S5	Oral communication skills, specifically the ability to present and defend a substantial piece of work, to engage with enquirers and respond effectively to questions.
***In addition, students achieving a Masters' will have*:**	
S6	The ability to identify material, from multiple published sources, relevant to a chosen topic, to comprehend and filter such material and from it synthesize principles or designs pertinent to a problem-solving project.
S7	Individual initiative, self-motivation, and problem-solving skills, fostered through the selection and taking through to completion of a practical, problem-solving project, leading to a dissertation and poster session.

8. Teaching, learning and assessment

Development of the learning outcomes is promoted through the following teaching and learning methods:

The teaching year is divided into two semesters of 15 weeks, plus a 12-week project period during the summer. The first 12 weeks of each semester are devoted to teaching. The programme is fully modular, delivered typically in units of 15 credits. Masters' students' study for 180 credits in a year (120 credits of taught modules and a 60-credit dissertation). A typical 15-credit unit corresponds to 20 formal lectures, 10 computer laboratory or problem-solving classes, 30 hours of self-study and further time (see below) for revision and assessment.

Learning is student-centred, that is, the School fosters an environment with many opportunities for individual and group learning, but the responsibility for learning rests with the student, who must be personally organised and self-motivated to make the most of the programme. Students are assigned to a personal tutor; they meet regularly to discuss progress and learning issues, and for pastoral care. Academic and technical advice may be sought at any time from lecturers, teaching assistants and supporting staff (initially, via email). Teaching is offered through induction procedures, formal lectures, computer laboratories, problem-solving classes, a personal tutorial system and project supervision.

Induction procedures in which students are provided with an introduction pack and participate in tutorial sessions. Contents of the pack include the MSc Student Handbook, and a School map enabling students to familiarise themselves with the layout of the School and the main computing facilities. During intro week, students participate in tutorials that introduce them to the resources available via the School web site and local intranet. Objectives *K1* and *S1* are supported through this.

Lectures are 50-minute formal presentations to a large class of students by a lecturer, who is responsible for the delivery of the module concerned. The purpose of a lecture is to motivate interest in a subject, to convey the core concepts and information content succinctly and to point students towards further sources of information. Lectures are interactive and students are encouraged to ask questions at suitable points. Students are expected to take notes during lectures, adding detail to published course materials. The objectives *K1-K4* are supported mainly through this mode; objective K5 is reinforced by it.

In some modules of the MSc programme, lectures are shared with undergraduate students. In such cases, MSc students receive added value through additional lectures or tutorials. Additionally, MSc students are assessed differently (e.g., by a more challenging formal examination paper) and are expected to achieve a higher level of attainment (the pass mark for taught postgraduate students is 50%, compared to 40% for undergraduate students).

Computer laboratories are 50-minute sessions, supervised by teaching assistants (and sometimes attended by the responsible lecturer) in which students work at a computer, to learn and practise a specific practical skill. The objectives *S1-S3* are promoted mainly through this mode, with indirect support for *K1-K4*.

Problem-solving classes are 50-minute sessions conducted by a lecturer with a class of students, in which exercises are completed interactively and solutions are provided within the period. The purpose of such a class is to help students engage practically with material presented in lectures and start to apply this knowledge. The objectives *K1-K4* are supported through this mode; objectives *K5* and *S2-S5* are reinforced by it.

Project supervision is a regular meeting held with an individual or group project supervisor. During the 20-50 minute session, students report on their progress to the supervisor, who highlights further areas of investigation, helps with technical problems, advises about the content and structure of technical reports and generally encourages the students to organise their time effectively. The objectives *S6-S7* are directly promoted through this mode, with *S2-S5* supported indirectly.

The transition from teaching to self-motivated learning is encouraged through specialist teaching materials such as lecture handouts or copies of lecture slides, which are typically supplied via the School of Computer Science website. Set course texts and more general background materials are available through the University libraries, at bookshops and also via the Internet. Students are responsible for obtaining textbooks and printing any material downloaded over the Internet. Active learning is fostered and promoted through engagement in practical work, such as exercises, assignments and projects. Additionally, students are expected to undertake private study.

Exercises are short tasks, either writing computer programs or working out solutions to other kinds of set problem, which are typically reviewed at the end of the session. Objectives *K1-K4* and *S1-S4* may be supported this way.

Assignments are offered over several weeks, typically involving the design and implementation of a software system to perform a given task, or the researching of a body of information leading to the writing of a discursive

essay on a given topic. Objectives *K1-K4* and *S1-S4* are supported by this.

Private study makes up more than half of the time allocated to each module. Students are expected to read around the topics of each module and follow directed reading from recommended course texts. Private study will include further investigations prior to exercises or projects and consolidates the lecture notes.

Opportunities to demonstrate achievement of the learning outcomes are provided through the following assessment methods:

For Masters' and Diploma students:

The last 3 weeks of each semester are devoted to examinations. Students are given the opportunity to reflect and revise for examinations during two *reading weeks* for each examined module, at least one of which occurs at the end of the 12-week teaching period.

Modular units may be assessed by examination, by an individual or group project, or by some combination of examination and a practical assignment. An examined 15-credit unit includes 2 hours examination time. An assessed assignment requires no more than 20 hours. A unit assessed entirely by project requires 30 hours per 10 credits of study.

Objectives *K1-K4* and *S2-S4* may be assessed by examination or coursework. Objective *S1* is not formally assessed, but is a skill acquired as a side-effect of working in a computer-based learning environment. Objectives *S5-S7* are assessed by individual project work.

Examinations are typically 2-hour question papers. Examinations test the knowledge objectives *K1-K4*, but also provide evidence of practical skill *S4*, and, to a lesser extent, evidence of previous engagement in *S2*.

Assignments are pieces of continuously assessed coursework, which students complete individually or in groups as directed. Assignments both develop and assess the practical skills *S2-S5*.

For Masters' students:

An **individual project** is completed during the summer. Students select a topic, research the background literature, and prepare a survey/analysis report at the interim assessment stage. They apply this knowledge in a practical, problem-solving project which contains a substantial design component and usually culminates in the production of a piece of software. The final assessment stage is by dissertation and poster session, assessed independently by two examiners. In the poster session, students give a software demonstration (if applicable), present a poster describing their project work and answer questions posed by the examiners. A further *viva voce* examination may be held to form a common view in cases of insufficient evidence or divergent opinions. The objectives *K5* and *S4-S7* are directly assessed, together with specialist areas of knowledge from *K2-K4*. Objective *K1* and practical skills in *S1-S3* may be assessed indirectly.

19. Reference points

The learning outcomes have been developed to reflect the following points of reference:

Internal

University Strategic Plan
http://www.sheffield.ac.uk/strategicplan

Teaching and Learning Strategy of the School of Computer Science.

Discussions with past and present members of the School of Computer Science Industrial Advisory Board (consisting of representatives from major companies in the IT industry, as well as more specialist consultancies and companies).

School annual student course evaluations and student feedback via the Staff-Student Liaison Committee.

External

Subject Benchmark Statements
https://www.qaa.ac.uk/the-quality-code/subject-benchmark-statements

Framework for Higher Education Qualifications (2014)
https://www.qaa.ac.uk/docs/qaa/quality-code/qualifications-frameworks.pdf

The UK Standards for Professional Engineering Competence (UK-SPEC), Third Edition, 2013.

Accreditation of Higher Educations Programmes (AHEP), Fourth Edition (2020).

Guidelines for accreditation by the British Computer Society (BCS).

Visiting accreditation panel of the British Computer Society (BCS) in 2022.

Peer review by a senior academic from a UK research-led University.

The workload fits comfortably within the guidelines laid down by the University, and is monitored by *external examiners*, who also review the content and standard of the programme.

The learning outcomes have also been developed to reflect the accreditation requirements of the International Speech Communication Association (ICSA) and European Chapter of the Association for Computational Linguistics (EACL).

20. Programme structure and regulations

The MSc in Computer Science with Speech and Natural Language Processing consists of 120 credits of taught modules and a 60-credit dissertation. The full-time programme is offered over 12 months starting in late September each year and finishing the following September.

The **core** modules consist of 120 credits (15 credits each):

- COM6012 Scalable Machine Learning
- COM6115 Text Processing (promoting K2, K3, S2, S3)
- COM6513 Natural Language Processing (promoting K2-K4, S2, S3)
- COM6502 Speech Processing (promoting K2, K3, S2, S3)
- COM6511 Speech Technology (promoting K2-K4, S2, S3)
- COM6509 Machine Learning and Adaptive Intelligence (promoting K3, S3)
- COM6103 Team Software Project (promoting K1-K4, S2-S5)
- COM6655 Professional Issues

The **dissertation** project consists of one module (60 credits):

- COM6906 Dissertation Project (promoting K1-K5, S1-S7)

Students who obtain 180 credits in total are awarded the degree of MSc. Exit awards of PG Diploma and PG Certificate can also be awarded to students who have obtained the appropriate number of credits as stated in the University regulations.

Detailed information about the structure of programmes, regulations concerning assessment and progression and descriptions of individual modules are published in the University Calendar available on-line at http://www.sheffield.ac.uk/calendar/.

21. Student development over the course of study

Students entering the programme will have had a prior education in a relevant discipline (typically engineering, computer science, linguistics, psychology or mathematics). This provides a foundation of knowledge and skills on which this MSc programme can build.

The programme consists of two semesters of taught modules and a dissertation project, which is completed during the summer. In the Autumn semester, the modules introduce core concepts and techniques such as mathematical and programming skills, techniques for processing text and speech by computer, and techniques for learning from data. The Spring semester modules build on this by providing more advanced coverage of speech and language technology, including automatic speech recognition and natural language processing.

Students' development over the course of their study is identified and measured through assessment of performance in each module, and monitored via regular meetings with a personal tutor who also offers pastoral care.

Masters' students are required to complete a research-based dissertation of approximately 15,000 – 20,000 words. This enables students to apply appropriate research techniques to a real problem in the field of computer science, and to engage at an in-depth level with an area of the subject which is of particular interest to them. Students may develop their own dissertation topics, in consultation with staff, or select from a list of possible topics generated by academic staff and industrial clients.

PG Diploma and PG Certificate students do not complete a dissertation project, hence learning outcomes K5 and S6, S7 do not apply. In addition, PG Certificate students will have successfully completed fewer modules

than MSc or PG Diploma students and are therefore expected to have an appreciation of some learning outcomes (K2-K4) rather than a thorough understanding of them.

22. Criteria for admission to the programme

Applicants for this programme will normally be expected to hold at least an upper second-class honours degree (or equivalent) in a relevant field, including (but not limited to) computer science, engineering, linguistics, psychology and mathematics. They should also hold an A level (or equivalent) in mathematics and should have some experience of computer programming. Any relevant work experience is considered advantageous, however candidates without such experience will be given equal consideration. Students whose first language is not English must hold an approved English language qualification.

Detailed information regarding admission to the programme is available at http://www.sheffield.ac.uk/dcs/postgraduate-taught

23. Additional information

The School of Computer Science is housed in the modern, purpose-built Regent Court building and has its own dedicated computing facilities. The School is internationally recognised for its teaching and research (in the 2021 Research Excellence Framework (REF), 99% of our research was rated in the top two categories, meaning it is classed as world-leading or internationally excellent). It has particular research strengths in the fields of natural language processing, speech technology, machine learning, robotics, computer graphics and software verification and testing.

The School of Computer Science MSc Student Handbook governs all local aspects of academic student life, with regard to services offered, computer etiquette, and local regulations.

This specification represents a concise statement about the main features of the programme and should be considered alongside other sources of information provided by the teaching School(s) and the University. In addition to programme specific information, further information about studying at The University of Sheffield can be accessed via our Student Services web site at http://www.sheffield.ac.uk/ssid.