

# 计算机科学与技术国际博士研究生培养方案

授予学位类别：工学博士学位

一级学科（专业类别）代码名称：0812 计算机科学与技术

二级学科（专业领域）代码名称：

081201 计算机系统结构

081202 计算机软件与理论

081203 计算机应用技术

0812Z1 通信系统与信息安全

0812Z2 软件工程理论与方法

制订单位：计算机学院（牵头）、（参与）

培养方案版本号：2020版

## 一、学科概况

The history of the discipline of Computer Science and Technology in Central South University can be traced back to the establishment of the Electronic Technology discipline in 1958. The department began to enroll undergraduate students in Computer Technology in 1972, began to recruit master students in 1982, and began to train doctoral students in 2000. The discipline is an authorized first-level discipline to confer a doctoral degree in computer science and to train postdoctoral researchers. The discipline is a key discipline in Hunan Province and was rated as excellent in all the past discipline evaluation. In the 4th round of national subject evaluation in 2017, the Computer Science and Technology discipline of Central South University was rated A-.

The department has strong faculty and has a high-level faculty including engineering academicians. There are currently 86 full-time teachers, including 26 professors, 39 associate professors, and 21 lecturers. Among them, there are 1 academician of the Chinese Academy of Engineering, 3 members of the Thousand Talents Program, 1 Cheung Kong Scholars Distinguished Professor, 1 Cheung Kong Scholars Lecture Professor. One professor receives the National Natural Science Fund for Distinguished Young Scholars. It has 3 winners of the Hunan Natural Science Fund for Distinguished Young Scholars, 1 winner of the Hunan hundred talents program, 3 outstanding talents of the Ministry of Education in the new century, and 5 University distinguished professors.

The department has the Cheung Kong scholars and innovative research team in university supported by the Ministry of Education of China, one National Engineering Laboratory of medical big data application technologies, one innovation and intelligence introduction base of medical big data analysis theory and application discipline, the Mobile Medical Key Laboratory of the Ministry of Education, the Medicine Big Data Collaborative Innovation Center supported by Hunan Province and several other provincial research platforms, the Hunan Province Key Laboratory of

medical big data collaborative innovation center, the Hunan Province Key Laboratory of network resource management and credible evaluation service, the Hunan Engineering Technology Research Center of Financial currency identification and independent service platform, the Hunan national defense science and Technology Key Laboratory of sound detection and information confrontation, The Hunan Province Key Laboratory of bioinformatics, the international scientific and technological innovation cooperation base of artificial intelligence and medical big data in Hunan Province, and the international scientific and technological innovation cooperation base of biological data processing in Hunan Province.

The discipline adheres to the tenet of "innovation leading, serving the society", and has achieved a series of theoretical and application fruits. It has received a large number of funding grants from National Natural Science Foundation, Hunan Province, the Ministry of science and technology, and industrial communities. It has won the National Natural Science Award and provincial and ministerial natural science and Technology Progress Award many times. It was ranked as a top 1% institute among all institutes that has the computer science discipline in the world according to the essential science index (ESI).

## 二、研究方向

### (1). Network Computing and Intelligent System

Aiming at the problems faced by traditional computing models in the era of the Internet of Things and big data, carry out basic theoretical research and application practice of new network computing models represented by transparent computing, mobile cloud computing, fog computing and edge computing, mainly for lightweight new network computing platform architecture for connected terminals, distributed machine learning and artificial intelligence algorithm design for lightweight terminals, IoT communication protocol design and network performance optimization based on new network computing models are being researched to actively promote the next generation demonstration application and industrialization of network computing platform.

### (2). Computing Theory and Algorithm

Aiming at the difficult combinational optimization problems in engineering applications, research on the theory and methods of difficult combinational optimization problems, research the multi-dimensional mathematical models of many combinational optimization problems, analyze the various parameters that affect the complexity of the problems, and re-perform the corresponding mathematical model to characterize and study effective solving algorithms for various types of combinatorial optimization problems from the perspective of parameterized algorithms, approximate algorithms, and stochastic algorithms. The aim is to establish a set of systems for the theory and methods of solving difficult combinatorial optimization problems.

### (3). Bioinformatics

Facing the massive biological data generated in the post-genomic era, the research of biometric-oriented data processing methods and new algorithms is carried out.

Through systematic analysis of different types of omics data such as genome, transcriptome, and proteome, it aims at genome assembly and structural mutation detection, protein complex mining, gene regulation network and construction of dynamic protein network and other hot issues, looking for hidden biological data features, aiming to establish a set of systems for biological data features-oriented multiomics data analysis methods.

#### (4). Computer vision and medical image processing

Conduct research in the fields of computer vision, graphic image processing, digital medical visualization analysis, medical big data processing, smart medicine, machine learning, and focus on interdisciplinary cooperation in the context of big data, including computer vision methods based on human vision mechanisms, face recognition technology, 3D digital medical and virtual simulation research, glaucoma, diabetic retina image analysis and disease screening, computer-aided diagnosis and radiotherapy of early liver cancer, etc.

#### (5). Network optimization and information security

Aiming at the optimization of new network application performance and information security goals, research on network service optimization and security guarantee mechanisms under various constraints, including data center networks, the Internet of Things, and mobile Internet data transmission and tasks under the constraints of resources and service guarantee optimization strategies for scheduling, distributed storage, etc. It also studies the security guarantee mechanisms of various network application services, including user data privacy protection technology, network application's own vulnerability and security detection technology, user data isolation and protection technology in cloud computing environment, and network security visualization. It aims to provide a solid research foundation for the service quality and security guarantee of new network applications.

#### (6). Data Science and Medical Big Data

It is a research direction for the integration of computer science and medicine. Based on the research of data acquisition, cleaning, granulation, clustering, fusion and comparison, it takes medical big data as the research object and builds a medical big data platform. For the purpose of research, it integrates and fuses medical data at all levels of relevant hospitals, in-depth researches on key technologies such as mining, analysis and effective use of medical big data, and key applications such as medical data security and privacy protection, medical data standards.

### 三、培养目标

Cultivate innovative high-level professionals in computer science and technology and related fields engaged in scientific research, technology development, and engineering applications:

(1) Have a good scientific research style, scientific morality and cooperative spirit, good morals, and physical and mental health. Have a rigorous and realistic scientific attitude and style. Have the knowledge of Chinese national conditions and

culture.

(2) Have a solid and broad basic theory of computer science and technology; master systems, in-depth computer software or theory and specialized knowledge about computer system structure, computer application technology; be familiar with the latest research results and development trends of this discipline; have pioneering spirit and forward-looking ability, with the ability to independently engage in frontier subject research and undertake major engineering technology projects, and achieve creative results in theoretical research or engineering technology applications; by intersecting with other disciplines, can use computer technology to solve a variety of research and applications projects; be able to engage in high-level teaching, scientific research, information system development and management in computer science and technology and other related disciplines;

(3) Master one or more foreign languages, be proficient in reading foreign language materials and writing scientific research reports and dissertations in the subject, and be capable of academic communication in foreign languages.

#### 四、学制和学习年限

Follow the "Regulations for the Postgraduates at Central South University". Basic schooling: 4 years. Undergraduate graduated directly to study doctoral students: 5 years. The maximum length of study for full-time doctoral candidates is: 7 years. The maximum length of study for non-full-time doctoral candidates is: 8 years. The deadline for calculating the maximum study period is August 31 of the current year.

Doctoral students with excellent overall quality can apply for graduation six months in advance. For the requirements and procedures for early graduation, please refer to the "Regulations for the Management of Postgraduates of Central South University" and the "Provisions for the Application for Early Graduation of Doctoral and Master's Degree Programs of Central South University".

#### 五、培养方式

(1). Implement the training group training system in which the mentor is responsible. The individual guidance combines with the collective guidance of the guidance group. The members of the guidance group should assist the mentor to guarantee the quality of each training link. To train doctoral students across disciplines, sub-mentors should be hired from related disciplines.

(2). The mentor guides graduate students to formulate personal training plans, select courses, consult literature, participate in academic exchanges and social practices, determine research topics, and guide scientific research.

(3). The mentor's research guidance, ideological education, and academic style education should be organically combined to comprehensively cultivate and improve the comprehensive quality of graduate students.

(4). There will be the elimination mechanism of the training process, strictly

evaluate and screen, and re-evaluate or eliminate the unqualified students. Specific implementation follows the "Administrative Measures for Central South University Graduate Assessment".

## 六、课程设置与学分要求

| 课程类别  | 学分要求   | 课程类别    | 学分要求 |
|-------|--|---------|------|
| 公共学位课 | 5  | 学科基础课   | 4    |
| 专业课   | 2  | 选修课     | 2    |
| 培养环节  | 4  | 学术交流与研讨 | 4    |
| 补修课   | 4  |         |      |
| 总学分   | 21   |         |      |
| 学分说明  | <p>(1) 实行学分制，博士生总学分不低于21学分，其中课程学习13学分、学术交流4学分、培养环节4学分。(2) 补修课是指跨学科或以同等学力考取的博士研究生必须加修的课程。博士生必须加修所考取学科硕士生阶段的专业基础课2门或以上。补修课计算学分，但不在博士生应修满的规定学分之内。(3) 对于博士研究生在国外留学期间所修的专业课程，由本人提供学习成绩证明原件和课程考试有关资料，由所在二级培养单位主管院长审核并认定为对应培养方案内的相应课程，到研究生院培养与管理办登记成绩</p> |         |      |

| 类别      | 课程编号        | 课程（环节）名称        | 学时 | 学分 | 开课学期 | 说明   |
|---------|-------------|-----------------|----|----|------|--|
| 公共学位课   | 10000003A01 | 中国概况            | 32 | 2  | 春秋季  | Compulsory<br>5 credits  |
|         | 11000003A01 | 汉语              | 64 | 3  | 秋季   |  |
| 学科基础课   | 47081201B02 | 算法与复杂性理论        | 32 | 2  | 春季   | Compulsory<br>4 credits  |
|         | 47081203B02 | 人工智能            | 32 | 2  | 春秋季  |  |
| 专业课     | 47081201C01 | 现代计算机应用技术       | 32 | 2  | 秋季   | Compulsory<br>2 credits  |
| 选修课     | 47081201B01 | 计算机科学与技术前沿      | 16 | 1  | 春季   | Compulsory<br>2<br>creditsPhD<br>Candidates<br>can choose<br>graduate<br>courses |
|         | 47081201D01 | 大数据前沿理论与方法      | 16 | 1  | 春季   |  |
| 选修课     | 47081203B01 | 论文写作与学术道德（计算机院） | 32 | 2  | 秋季   | Mandatory<br>Ph. D. stage<br>required if<br>Master\'s<br>degree not<br>completed |
| 培养环节    | 99000003F06 | 学位论文选题报告        |    | 1  | 春秋季  | 第三学期   |
| 培养环节    | 99000003F05 | 博士生资格考试         |    | 1  | 春秋季  | 第三学期   |
| 培养环节    | 99000003F07 | 中期考核            |    | 1  | 春秋季  | 第五学期   |
| 培养环节    | 99000003F08 | 社会实践            |    | 1  | 春秋季  |  |
| 学术交流与研讨 | 99000003F02 | 学术交流与研讨（博士生）    |    | 4  | 春秋季  |  |

## 七、学术研讨与学术交流

"Academic seminars and academic exchanges" is a compulsory link for all doctoral students, and requires 4 credits. By carrying out multi-channel, multi-form, and diversified academic seminars and academic exchange activities, we create a strong academic and cultural atmosphere, lead the frontier, stimulate interest, and expand knowledge span and academic horizons.

For detailed content and assessment methods, please refer to the “Implementation Rules for Academic Discussion and Assessment of Academic Exchanges in the Training Program of School of Computer, Central South University”

8.

## 八、博士生资格考试

Doctoral candidates have to take part in the qualification examination, before making their dissertation proposal to determine their research topic. The doctoral qualification exam is taken in the third semester after admission. Examination consists of written and oral examinations, and will be carried out according to the First Level Discipline. Details are given as following:

Social behavior, moral and scientific attitude;

The implementation of individual training plan and curriculum learning grade;

The basic theories, professional knowledge, modern science and technology knowledge and skills;

The understanding of the disciplines, the dynamics and progress of the latest research in related fields at national and international levels.

The quality of scientific research, innovation and development potential.

Doctoral candidates have two chances to pass the qualification examination; otherwise they will be required to quit the program. Specific implementation follows the “Administrative Measures for the PhD Examination of Central South University”.

## 九、学位论文开题报告

Under the guidance of a mentor, graduate students should determine the research direction of the dissertation in the first semester, and make a public proposal defense on the basis of consulting a large number of literature materials to determine the research topic. Doctoral students should search and read more than 120 documents, of which high-quality Chinese literature should generally be more than one-third.

The proposal defense will be completed in the third semester after the admission of doctoral students. The topic selection of a dissertation should be based on the forefront of the discipline, be able to make innovative results in theory or technology, and have great practical or potential value. Those who fail to pass the first proposal defense should make up within one year. Reports on the proposal of doctoral candidates should be held publicly within the scope of the discipline.

Graduate students fill in the online version of the “Central South University Graduate Thesis Selection Report” on the “Graduate Education Management Information System”. After the review of the proposal report is approved, it will be filed and registered with the graduate management office of the unit.

## 十、中期考核

The mid-term assessment is a compulsory part for doctoral students, and is implemented in accordance with the "Management Measures for the Graduate Training of Central South University".

In the 5th semester after the admission of doctoral students, the school will organize a comprehensive summary, evaluation and assessment of doctoral students' performance, curriculum academic performance, and scientific research performance. Unqualified students will be processed according to the regulations for the management of postgraduate student status.

## 十一、科研训练、专业实践和社会实践

Doctoral students in this discipline must complete the practical teaching tasks arranged by the school or participate in social practice. He can teach part of the course according to the situation, assist and guide master students; the workload is 50 hours, or participate in "three trips to the countryside" activities (more than 0.5 months), etc., 1 credit.

## 十二、学年总结与考核

Before the school year holidays, a comprehensive evaluation and test will be taken, mainly including students' morality performance, course achievements, scientific research achievements and so on. The assessment results serve as the basis for judging students and adjusting their scholarship level. Students who fail to pass the test will be punished according to the regulations on graduate students' status management.

## 十三、学位论文工作

(1) Academic achievement requirements.

In strict accordance with the "Central South University Computer Science and Technology First-level discipline doctoral and master's degree awarding standards" and degree management related documents.

(2) Requirements for dissertations

In strict accordance with the "Central South University Degree Awarding Work Regulations", "Central South University Computer Science and Technology Subject Doctoral Degree, Master Degree Awarding Standards", "Central South University Graduate Degree Thesis Writing Regulations", "Central South University Graduate Degree Thesis Academic Misconduct Detection Mistakes Management Measures" Requirements.

(3) Paper review, defense and degree award

Strictly implement the requirements of the "Central South University Degree

Awarding Work Regulations”, “Central South University’s Defense Management Measures”, and “Central South University Graduate Degree Thesis Evaluation Management Methods” requirements.

#### 十四、毕业论文工作

According to the “Implementation Measures for Separation of Graduation and Degree Granting for Doctoral Students from Central South University”, those who have not met the requirements for degree granting may apply for defense of graduation thesis. Graduation thesis requirements are as follows:

##### 1) Requirements on Academic Papers

The academic achievements did not meet the requirements of the “Computer Science and Technology Level 1 Subject Doctoral and Master Degree Awarding Criteria”, but there were 2 published EI journal papers or conference papers.

The above academic achievements must be closely related to the degree thesis. The paper should use Central South University as the first unit. The mentor ranks first, the graduate ranks second or the graduate ranks first. The papers published during the study shall be the ones published in the journal (excluding supplements). The search source journals shall be subject to the catalog of journals published in the year when the doctoral candidate submitted the manuscript.

##### 2) Requirements on Dissertation

Follow the requirements of the dissertation in this training plan.

##### 3) Requirements on Dissertation Defense

Follow the procedures and requirements of the dissertation review and defense in this training plan. Other matters shall be implemented in accordance with the “Implementation methods for the Separation of Doctoral Degree Graduation and Degree Awarding of Central South University (Trial)”

附:

附: 修订专家名单

王建新、邓晓衡、王斌、刘伟荣、冯启龙、张士庚、张祖平、廖胜辉、赵颖、王伟平、黄家玮、黄东军、夏佳志、刘安丰