# Data Science Doctoral Degree Program Course Flowchart

## Required Courses

- Special Project
- Seminar
- Thesis

### Other Requirements

- Language Proficiency Requirements(EN)
- Academic Ethics Courses
- Qualifying Examination
- Proposal
- Thesis Review

## Fundamental Courses (9)

At least 9 credits, excess credits may be counted as selective courses (except for courses with the same title)

At most 1 course can be counted

- Machine Learning(4)
- Machine Learning(3)
- Applied Deep Learning (3)
- Artificial Intelligence (3)

- Computational Methods for Data Science(3)
- Statistical Foundations of Data Science (I) (3)
- High-Performance Big Data and Artificial Intelligence Systems (3)

## Elective Courses(9)

Courses from supporting academic units (U, M, D) include, but are not limited to, the following courses

### Examples of tool / method courses

#### Mathematics and Statistics

- Numerical Linear Algebra
- Probability Theory (I), (II)
- Regression Analysis
- Multivariate Statistical Analysis
- Statistical Computing
- Bayesian Statistical Methods
- Convex Optimization
- Online Convex Optimization
- Optimization Algorithms
- Advanced Algorithms
- Advanced Methods in Optimization Algorithms
- Mathematics in Deep Learning
- Statistical Learning
- Computational Methods for Data Science
- Data Analysis and Manifold Learning
- Data Analysis and Manifold Learning
- Mathematics in Signal Processing and Machine Learning
- Advanced Statistical Inference(I), (II)

#### Computer Science

- Big Data Systems
- Robotics
- Data Science
- Artificial Intelligence
- Advanced Artificial Intelligence
- Trustworthy Artificial Intelligence
- Natural Language Processing
- Topics in Machine Learning
- Digital, AI and Emerging Computing Architecture
- Introduction to Generative Artificial Intelligence
- Information Retrieval and Extraction

### Examples of application courses

- Bioinformatics
- Biomedical Statistics
- Artificial Intelligence and Intelligent Medicine
- Computational Social Science
- The practical implementation of artificial intelligence in medical images
- AI for Medical Image Analysis
- Medical Imaging Syestems
- Medical Image Processing
- Application of Big Data System
- Advanced Deep Learning
- Security and Privacy of Machine Learning
- Nonlinear Optimization: Theory and Applications
- Applied Deep Learning
- Cryptography and Network Security
- Deep Learning for Medical Imaging
- Computer Vision Practice with Deep Learning
- Deep Learning for Computer Vision
- Computer Communication Networks
- Distributed Machine-Learning System
- 3D Computer Vision with Deep Learning Applications
- Deep Learning for Music Analysis and Generation
- Deep Learning for Human Language Processing
- NLP and Information Retrieval with Applications in Social Networks
- Frontiers of Artificial Intelligence of Things
- Introduction to Social Networks
- Introduction to Artificial Intelligence of Things and its Applications

### Recommended courses for undergraduate students

- Probability
- Calculus
- Statistics
- Numerical Analysis
- Linear Algebra
- Algorithms
- Database
- Data Structure
- Discrete Mathematics
- Computer Programming
- Introduction to Computer Science
- Introduction to Computational Mathematics
- Introduction to Computer Networks