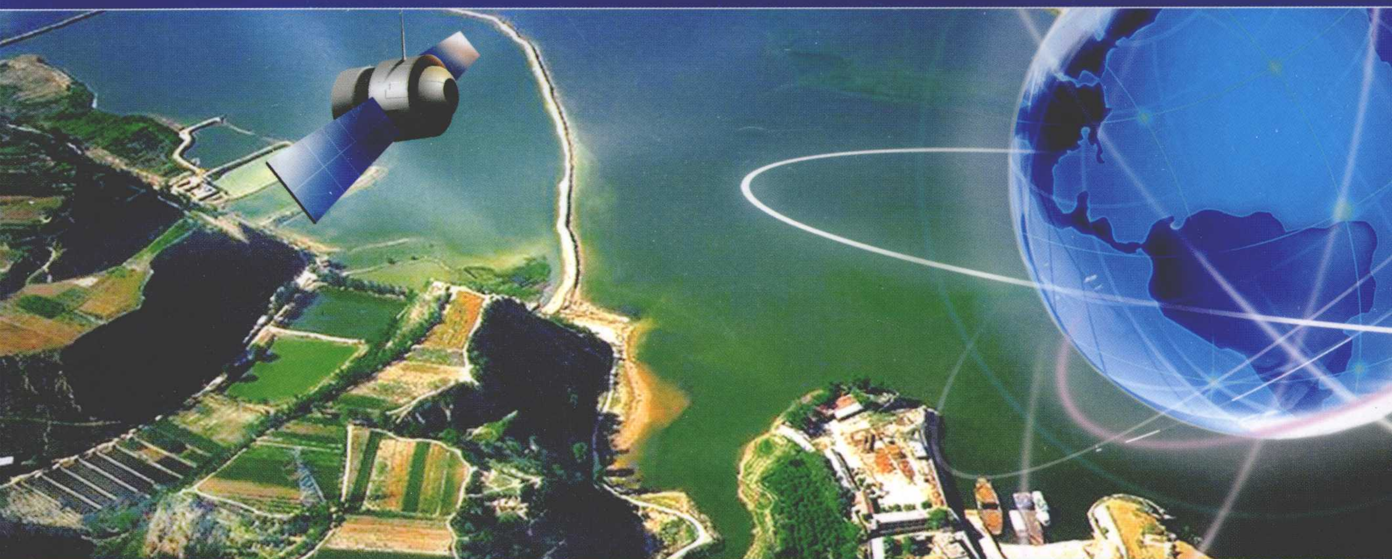
GIS专业英语教程

费立凡　何　津　王新生　编著



WUHAN UNIVERSITY PRESS
武汉大学出版社

GIS专业英语教程

费立凡　何　津　王新生　编著

WUHAN UNIVERSITY PRESS
武汉大学出版社

图书在版编目(CIP)数据

GIS专业英语教程/费立凡,何津,王新生编著.—武汉:武汉大学出版社,2010.9
ISBN 978-7-307-07961-8

Ⅰ.G… Ⅱ.①费… ②何… ③王… Ⅲ.地理信息系统—英语—高等学校—教材 Ⅳ.H31

中国版本图书馆CIP数据核字(2010)第119644号

责任编辑:谢群英　　责任校对:刘　欣　　版式设计:支　笛

出版发行:武汉大学出版社　(430072　武昌　珞珈山)
(电子邮件:cbs22@whu.edu.cn 网址:www.wdp.com.cn)
印刷:武汉中远印务有限公司
开本:787×1092　1/16　印张:17.75　字数:423千字
版次:2010年9月第1版　2010年9月第1次印刷
ISBN 978-7-307-07961-8/H·698　定价:28.00元

前　言

在过去的十年间，GIS 已经从一个高度专业化的领域发展为影响我们生活方方面面的技术，从驾车导航到自然灾害管理，随处可见 GIS 的深入应用。GIS 直到几年前还只有少数研究人员、决策人员和政府职员才能使用，现在几乎每个人都可以创建个性化地图或对 GIS 数据进行叠置分析。

近年来 GIS 发展势头迅猛，新技术层出不穷，软件频频升级、设备不断更新。要跟上 GIS 发展的潮流，就必须不断地了解和掌握 GIS 最新的发展动态，这就对 GIS 专业人员的英语水平提出了较高要求，因此 GIS 专业人士都在竭力提高自己的专业英语水平，以便高效地获取 GIS 新技术信息。同时各大专院校也把 GIS 专业英语作为必修课，以提高学生的专业英语水平，培养和提高学生运用英语的能力，从而使其具备更高的综合素质及竞争能力。

结合多年 GIS 双语教学及专业英语阅读教学的经验以及相关教改项目的研究成果，编著者按照 GIS 专业教学计划编写了这本教材，其特点如下：

1. 原汁原味，教材课文皆来自英文原文，适当之处进行了相应修改，以符合教学目的。

2. 系统性与广博性相结合。本书分 6 个部分：GIS 的基本概念、GIS 的数学基础、GIS 的数据结构和数据库、空间数据采集、空间分析、GIS 的应用与新发展。内容涵盖了 GIS 的各个方面。

3. 教材取材突出“新”字，收集了万维网地理信息系统、三维地图信息系统、基于地图的移动服务、开源软件与 GIS 等 GIS 发展的新技术和新领域。

4. 结合科技英语翻译知识，强化专业阅读训练，以提高广大学生和读者的专业英语综合技能。

5. 每课附有首次出现的专业术语和生词的中英文对照注释，为广大读者理解和提高阅读技能提供了帮助。

6. 配合学习内容，每章后附自测练习，以考查学生对课文的理解程度。

7. 为便于理解，相应课文中附有相关的图表。

8. 为了加强广大学生理解英文原文，部分课文没有给出相应的译文。

感谢颜辉武副教授在本书构思、规划阶段提出的宝贵意见；编写过程中得到林子榆同学、姚玲博士、黄丽娜博士的大力帮助，在此致以衷心感谢。由于编者水平和经验有限，书中欠妥与谬误之处在所难免，希望广大专家和读者不吝赐教。

编　者

2010 年 7 月

目　录

Part Ⅰ　The Basic Concept of GIS 1
Lesson 1　What Is GIS 1
New Words 3
Exercises 3
Lesson 2　What Kinds of Functions Does a GIS Have? 4
New Words 9
Exercises 10
Lesson 3　Origins and Applications of GIS 11
New Words 15
Exercises 16

Part Ⅱ　The Basic Mathematical Concept of GIS 17
Lesson 4　What Are Map Projections? 17
New Words 21
Exercises 22
Lesson 5　Classification of Map Projections and Their Applications 23
New Words 25
Exercises 25

Part Ⅲ　Data Structure and Database of GIS 26
Lesson 6　GIS Data Models 26
New Words 33
Exercises 35
Lesson 7　Raster Models 36
New Words 40
Exercises 41
Lesson 8　Compact Storing of Raster Data 42
New Words 45
Exercises 45
Lesson 9　Vector Models 46
New Words 51
Exercises 52
Lesson 10　Compacting Vector Data Model 53

New Words ········ 54
Exercises ········ 54
Lesson 11 Vector to Raster Conversions ········ 55
New Words ········ 63
Exercises ········ 64
Lesson 12 Raster to Vector Conversions ········ 65
New Words ········ 76
Exercises ········ 77
Lesson 13 Quad-Tree Model and Octree Representation of Solids ········ 78
New Words ········ 84
Exercises ········ 84
Lesson 14 Digital Evation Modelling ········ 85
New Words ········ 87
Exercises ········ 88

Part IV Acquisition of Spatial Data ········ 89
Lesson 15 Data Sources Ⅰ ········ 89
New Words ········ 95
Exercises ········ 96
Lesson 16 Data Sources Ⅱ ········ 97
New Words ········ 100
Exercises ········ 101
Lesson 17 Surveying ········ 102
New Words ········ 104
Exercises ········ 105
Lesson 18 Satellite Positioning System ········ 106
New Words ········ 110
Exercises ········ 111
Lesson 19 Photogrammetric Mapping ········ 112
New Words ········ 115
Exercises ········ 115
Lesson 20 Collection of Attribute Data and Text Data ········ 116
New Words ········ 121
Exercises ········ 122

Part V Spatial Analysis ········ 123
Lesson 21 Data Analysis Ⅰ ········ 123

New Words ········ 127
Exercises ········ 128
Lesson 22 Data Analysis Ⅱ ········ 129
New Words ········ 135
Exercises ········ 137

Part Ⅵ Applications and New Development of GIS ········ 138
Lesson 23 Three-Dimensional GIS ········ 138
New Words ········ 144
Exercises ········ 145
Lesson 24 Map-based Mobile Services ········ 146
New Words ········ 151
Exercises ········ 152
Lesson 25 Open Source Software and GIS ········ 153
New Words ········ 158
Exercises ········ 158
Lesson 26 Web GIS ········ 159
New Words ········ 161
Exercises ········ 162
Lesson 27 Contemporary GIS and Future Directions ········ 163
New Words ········ 166
Exercises ········ 167

部分参考译文 ········ 168

第一部分 GIS 的基本概念 ········ 168
第 1 课 地理信息系统是什么? ········ 168
第 2 课 GIS 有哪些基本功能? ········ 170
第 3 课 地理信息系统的起源与应用 ········ 175

第二部分 GIS 的数学基础 ········ 179
第 4 课 地图投影是什么? ········ 179

第三部分 GIS 的数据结构和数据库 ········ 183
第 6 课 GIS 数据模型 ········ 183
第 7 课 栅格模型 ········ 189
第 9 课 矢量模型 ········ 193
第 11 课 矢量到栅格的转换 ········ 197

第 14 课　数字高程模型 …… 203

第四部分　空间数据采集 …… 205
第 15 课　数据源 1 …… 205
第 17 课　测量 …… 210
第 18 课　卫星定位系统 …… 212

第五部分　空间分析 …… 216
第 21 课　数据分析 1 …… 216

第六部分　GIS 的应用与新发展 …… 220
第 23 课　三维地图信息系统 …… 220
第 24 课　基于地图的移动服务 …… 225
第 25 课　开源软件与 GIS …… 229
第 26 课　万维网地理信息系统 …… 233
第 27 课　当代 GIS 与未来发展方向 …… 235

附录　科技英语翻译实践与技巧 …… 238

第一章　翻译标准 …… 238

第二章　译者素养 …… 240

第三章　词类的转译 …… 242
一、转译成动词 …… 242
二、转译成名词 …… 243

第四章　句子成分的转译 …… 244
一、转译成主语 …… 244
二、转译成谓语 …… 245
三、转译成定语 …… 246
四、转译成状语 …… 247
五、转译成补语 …… 248
六、转译成宾语 …… 248
七、转译成表语 …… 249

第五章　增译 …… 250
一、省略句时的增译 …… 250

二、逻辑要求引起的增译……250
三、重复引起的增译……251
四、表达含蓄意义引起的增译……251
五、增加概括性或分述性词语引起的增译……251
六、增加量词引起的增译……251
七、抽象名词、不及物动词和形容词的含义具体化而引起的增译……251
八、增加表示复数的词引起的增译……252
九、增加表示时态和方向的词引起的增译……252
十、增加关联词语引起的增译……252
十一、修辞需要引起的增译……253
十二、被动句和祈使句引起的增译……253

第六章 减译……254
一、冠词的减译……254
二、代词的减译……254
三、连接词的减译……255
四、介词的减译……255
五、动词的减译……255
六、名词的减译……256
七、同义词和近义词的减译……256
八、文字简洁导致的减译……256
九、合句导致的减译……257

第七章 量词增译……258
一、量词的形象性……258
二、量词的习惯性……258
三、量词的地方性……259
四、量词的感情色彩……259
五、量词的位置及匹配……259
六、增译量词应避免重复……259
七、不要增补冗余量词……260
八、量词的省略……260

第八章 分译……261
一、单词的分译……261
二、短语的分译……262
三、句子的分译……262

第九章　合译…… 264
一、单句的合译…… 264
二、主从复合句的合译…… 264
三、并列复合句的合译…… 264
四、把复句和单句或复句和复句合译成单句或复句…… 265
五、多重复句合译成较简单的复句…… 265

第十章　数量增减的译法…… 266
一、数量的净增…… 266
二、倍数增加…… 267

References …… 270

Part Ⅰ

The Basic Concept of GIS

Lesson 1 What Is GIS

What are geographic information systems?

In the broadest possible terms, geographic information systems are tools that allow for the processing of spatial data into information, tied explicitly to, and used to make decisions about, some portion of the earth. This working definition is neither comprehensive nor particularly precise. Like the field of geography itself, the term is difficult to define and presents the integration of many subject areas. As a result, there is no absolutely agreed upon definition of a geographic information system. The term itself is becoming hybridized and modified to conform to intellectual, cultural, economic and even political objectives (Table). This terminology has, in fact, become extremely elastic, resulting in an increasingly confusing jargon due to new definitions that constantly creep into both the scientific and the popular literature.

Table **Examples of Synonymous Terms for Geographic Information System and the Source or Motivation behind Their Derivation**

Terminology	Source
Geographic information system	United States terminology
Geographical information system	European terminology
Geomatique	Canadian terminology
Georelational information system	Technology-based terminology
Natural resources information system	Discipline-based terminology
Geoscience or geological information system	Discipline-based terminology
Spatial information system	Nongeographical Derivative
Spatial data analysis system	Terminology based on what system does

This lack of accepted definition has resulted in many gross misconceptions about what a GIS is, what its capabilities are, and what such a system might be used for. It has lead some people to believe, for example, that there is no difference between computer assisted cartography, computer assisted drafting, and GIS. Because the graphic display from these three systems can look identical to both the casual and the trained observer, it is easy to assume that they are, with minor differences, the same thing. Anyone attempting to analyze maps will soon discover, however, that computer assisted cartographic (CAC) systems, computer systems designed to create maps from graphical objects combined with descriptive attributes, are excellent for display, but generally lack the analytical capabilities of a GIS. Likewise, for pure mapping purposes it is highly desirable to use a computer assisted cartographic system developed specifically for the input, design, and output of mappable data, rather than working through the myriad analytics of the GIS to produce a simple map. Computer assisted drafting (CAD) — (a computer system developed to produce graphic images but not normally tied to external descriptive data files) — is excellent software for the architect, speeding the process of producing architectural drawings, and simplifying the editing process. It would not be as easy to use for producing maps as would CAC, nor would it be capable of analyzing maps — generally the primary tasks assigned to the GIS.

For the experienced user of GIS technology, there is no need for a definition. The complex geographical queries that demand its use normally could not be addressed by CAC and CAD. But for those who have only heard of these tools a definition might prove useful. A preliminary definition for consideration might be that of David Rhind, who defined GIS as "a computer system for collecting, checking, integrating and analyzing information related to the surface of the earth". This definition has some highly worthwhile elements that should be examined. First, it indicates that the GIS deals with the surface of the earth. Although this is not an absolute requirement, the vast majority of GIS applications do deal with portions of the earth. Moreover, the statement that the GIS is used to collect, check, integrate, and analyze information enumerates a large number of the necessary groups of operations for any geographic information system.

Many additional definitions of GIS have been proposed. Some have shown the strong linkage between manual and computer-based methods of map analysis. Most others have explicitly stated among its primary objectives, to act as a tool for analyzing data about the earth. As we will see at the end of this text, one can also extend the definition to include the organization and people involved in working with spatial data as well. Like any technology that changes as quickly as does GIS, the definitions themselves will likely change as well.

For this text I have chosen to use a definition that more closely resembles the way the GIS operates as a series of subsystems within a larger system. That definition proposed as a standard by Marble and Peuquet, and used in some form by others in their own definitions, pretty much sums up what it is we do with a GIS and how we do it. It states that GIS deals with space-time data, and often, but not necessarily, employs computer hardware and software. More importantly, perhaps, is the subsystem nature of his definition that provides an easily understandable framework for the study of GIS. The GIS, according to this definition, has the following subsystems:

- A data input subsystem that collects and preprocesses spatial data from various sources. This subsystem is also largely responsible for the transformation of different types of spatial data (i. e. , from isoline symbols on a topographic map to point elevation inside the GIS).
- A data storage and retrieval subsystem that organizes the spatial data in a manner that allows retrieval, updating, and editing.
- A data manipulation and analysis subsystem that performs tasks on the data, aggregates and disaggregates, estimates parameters and constraints, and performs modeling functions.
- A reporting subsystem that displays all or part of the database in tabular, graphic, or map form.

(本文节选、改编自 *Fundamentals of Geographic Information Systems*, 详见 *Reference* [1])

New Words

comprehensive [ˌkɔmpriˈhensiv] *adj.* 全面的；无所不包的；综合性的
intellectual [ˌintəˈlektʃəl] *adj.* 智力的；才智的
jargon [ˈdʒɑːg(ə)n] *n.* 专业术语
terminology [ˌtəːmiˈnɔlədʒi] *n.* 专门用语
geomatique [dʒiəˈmætik] *n.* 地理信息技术
geoscience [ˌdʒi(ː)əuˈsaiəns] *n.* 地球科学
derivative [diˈrivətiv] *n.* 派生物；衍生物
cartography [kɑːˈtɔgrəfi] *n.* 地图绘制学；地图绘制
architect [ˈɑːkitekt] *n.* 建筑师
preliminary [priˈliminəri] *n.* 初步的；起始的；预备的
enumerate [iˈnjuːməreit] *v.* 列举；枚举
resemble [riˈzembl] *v.* 像；与……相似
transformation [ˌtrænsfəˈmeiʃən] *n.* 转换

Exercises

1. List some examples of synonymous terms for GIS.
2. What's the subsystems of GIS defined in this text?

Lesson 2 What Kinds of Functions Does a GIS Have?

The subsystem definition allows for easy comparison between the modern *automated* GIS and its analog counterpart, particularly when considering the steps in the cartographic process (Table 1). The first GIS subsystem, the data input subsystem, is roughly *equivalent* to the first and second steps in the cartographic process — data collection and map compilation (Table 2). In traditional cartography the *cartographer* compiles or records a map made up of points, lines, and areas on a physical medium such as paper or *Mylar*. The data are collected from such sources as aerial photography, digital remote sensing, surveying, visual description, and census and statistical data. The automated counterpart uses electronic devices to record or encode points, lines, and areas into a computer system. Data collection sources are often the same as those used for traditional mapping, but now, include a wide variety of digital sources: digital line graphs, digital elevation models, digital orthophotoquads, and many more. Although the mechanics differ between the two technologies, the actual methods are strikingly similar.

Table 1 **Comparison of the Cartographic Process as Applied to Traditional Cartography (Map) and Geographic Information System (GIS)**

Map	**GIS**
Data collection: aerial photos, surveys, etc.	Data collection: aerial photos, surveys, etc.
Data processing: aggregation, classing, etc.; linear process	Data processing: aggregation, classing, plus analysis; circular process
Map production: final step except for reproduction and dissemination	Map production: not always final step; normally one map used to produce still more
Map reproduction	Map reproduction

Table 2 **Analog Versus Digital GIS: A Comparison of Input Subsystem Functions**

Map	**GIS**
Input: recorded (compiled) on paper from a collected source	Input: "encoded" into the computer from a collected source

Continued

Map	GIS
• Points	• Points
• Lines	• Lines
• Areas	• Areas
Sources	Sources
• Aerial photography	• Same as map data
• Digital remote sensing	• Digital Line Graph (DLG)
• Surveying	• Digital Elevation Models (DEM)
• Visual descriptions	• Digital Orthophotoquads
• Census data	• Other digital databases statistical data, etc.

This is also the case for the second subsystem, the storage and retrieval subsystem (Table 3). Although there is no actual counterpart in the cartographic method, the map itself is the storage and retrieval tool. Points, lines, and areas that have been placed on the cartographic document are stored there for retrieval by the map reader. It has been said that the map is the most compact medium for the storage of spatially related information and may be the most complex form of graphic device available. In fact, the compactness of the map and its complexity frequently hamper the map reader's ability to extract information.

Table 3 **Analog Versus Digital GIS: A Comparison of Storage and Retrieval Subsystem Functions**

Map	GIS
Points, lines, and areas are drawn on paper with symbols.	Points, lines, and areas are stored as grid cells or coordinate pairs and pointers in computer.
Retrieval is simply a matter of map reading.	Attribute tables are associated with coordinate pairs.
	Retrieval requires efficient computer search techniques.

The GIS storage and retrieval subsystem has some advantages over the graphic map in that queries can be made of the data and only the appropriate, context-specific information recalled. This format places more emphasis on formulating queries and asking the appropriate questions and less on overall map interpretation. In general terms, this subsystem stores, either explicitly or implicitly, the graphic locations of point, line, and area objects (entities), and their associated characteristics (attributes). Computer search methods are inherent in the GIS programs themselves to allow questions to be asked and for appropriate answers to be given.

In the analysis subsystem, once again there is no exact cartographic method counterpart, except that the map is a fundamental tool for the analysis of spatially related data (Table 4). The analog map requires rulers to measure distances, compasses to find directions and dot grids or planimeters to measure areas. Furthermore the map analyst is restricted to the graphic methods used to present the data on the piece of paper or Mylar. Still, these map analysis tools have been used for a great many years because of the known utility of comparing spatially related phenomena in a quantitative manner.

Table 4 **Analog Versus Digital GIS: A Comparison of Analysis Subsystem Functions**

Map	GIS
Requires rulers, planimeters, compasses, and other tools all used by the human analyst	Uses the power of the computer to measure, compare, and describe contents of the database
Restricted to the data as they are aggregated and represented on the paper map	Allows ready access to the raw data and allows aggregation and reclassification for further analysis

The analysis subsystem is the heart of the GIS. *The need to analyze maps to compare and contrast patterns of earth-related phenomena, exemplified by the long-standing tradition of doing so with traditional maps, provides an impetus to find more convenient, faster, and more powerful methods.* GIS analysis uses the power of the modern digital computer to measure, compare, and describe the contents of the databases. It allows ready access to the raw data and allows aggregation and reclassification for further analysis. Not only is it not limited in the types of data it can retrieve but it can combine selected data sets in unique and useful ways far beyond what the traditional map could provide on a single sheet.

Of course, once an analysis has been performed, there is generally a need to report these results. In cartography, whether it be traditional analog cartography or its digital equivalent, computer assisted cartography, the output is generally the same — a map. The most common purpose of cartography, at least from the user perspective, is to produce a map product, usually in copies for multiple recipients. In fact, production and reproduction are the final two steps in the cartographic method.

A major difference between GIS and cartography, beyond the emphasis on analysis in GIS, is the method of reporting the results of analysis (Table 5). Although many users, perhaps even most, will still require mapped output, there are many options available in modern GIS. Some typical noncartographic output could include tables listing, for example, the anticipated crop yields per hectare by soil type or predicted changes in population densities by census district. Alternatively, either of these results also could be output as a series of histograms or line graphs. Supplementally, digitally encoded photographs of selected sites could be placed on the map margins or within the tables or charts.

Table 5 **Analog Versus Digital GIS: A Comparison of Reporting and Output Functions**

Map Output	**GIS Output**
Graphic device only	The map is only one type of GIS output
Many forms of maps	With minor exceptions, GIS offers same options as traditional hand-drawn maps
Modifications can include cartograms, etc.	Also includes tables, charts, diagrams, photographs, etc.

More advanced GIS features are available, as well. Examples include output in the form of printed mailing labels for a search of a database of potential customers to facilitate the distribution of advertising. A 911 emergency system database could be connected to a police or fire department, so that when a caller reports an emergency, the information can be directly routed to the nearest emergency service. This output could also be in the form of a route map showing the fastest path from the emergency branch to the site of the emergency. In fact, the types of output are often dictated more by the use for which the GIS is employed than by the software. And, like the users of maps, the outputs are many and varied.

Among the more interesting phenomena arising from the wide range of users is a new set of terms defining the system on the basis of what it does. For example, one could have a police information system, a natural resources information system, a census information system, a rangeland evaluation system, a land information system, a

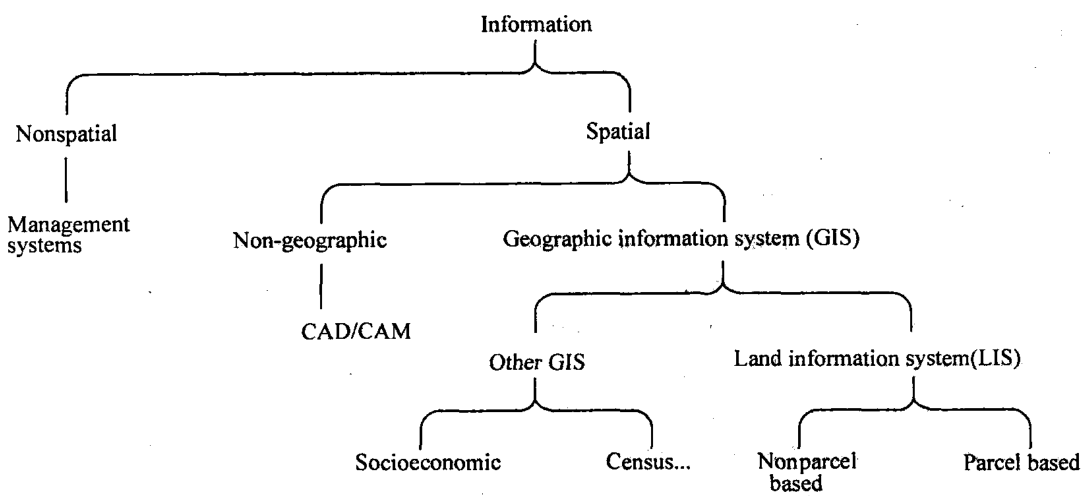


Figure A Taxonomy of Information Systems. The Illustration Shows How GIS and LIS Fit in.