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人工智能

魏巍　谢致誉　主编

Artifical Intelligence

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前　言

世界的发展需要中国，中国的富强也离不开世界。打开国门，与全世界交流，才是中国发展的正确道路。尤其是随着中国成功地加入 WTO，科技英语的地位显得更为重要，国际、国内的许多公司企业迫切需要掌握这项技能的人才。为了适应社会的发展和需要，同时为了配合目前高等学校纷纷设立的双语课程的教学，我们专门组织各高校工科专业的青年教师骨干和学术学科带头人编写了《21 世纪高新科技专业英语阅读系列》丛书。

本丛书共分 8 册，包括：《材料科学与化学工程》、《计算机与信息技术》、《光电世界》、《电子世界》、《现代通信技术》、《航空航天技术》、《生物工程与医学》、《人工智能》。

每个分册都在精选富有时代感和代表性文章的基础上，精心设计了技术背景、词语注释、句子注释三个方面的内容。技术背景能帮助读者进一步了解各项科学技术在全世界的发展、现状以及未来；词语注释、句子注释能使读者更好地理解文章内容，并进一步掌握专业词汇和语句。其中：

《材料科学与化学工程》用通俗易懂的语言讲述了材料科学和化学工程的各个研究方向，使读者对这两个学科有较全面的了解。本书在选材方面注意了材料科学和化学工程领域内的最新科技进展，使读者能够追踪到两个学科的研究发展前沿。

《计算机与信息技术》是一系列当今热点技术的汇总，覆盖了几乎整个计算机与信息技术领域内的相关内容。无论是早期的电

话网、大型电脑和半导体技术，或是新兴的 Internet、局域网、个人电脑及重要软件；无论是最新的理论研究，或是实践中的重大成果，都有相关的英语文章与之相对应。

《光电世界》主要讲述了光电技术的应用，包括电力市场、太阳能发电、电子碰撞电离现象、电荷耦合器件、全光逻辑器件以及光子学的研究等知识。

《电子世界》收集了可编程逻辑电路、转换脉冲、数字信号处理、动态随机存储器、混合信号设计及有关电子工程技术各个方面的知识。

《现代通信技术》讲述了现代通信技术的各种方式以及各种通信系统，并对下一代通信方式进行了预测：随着社会经济的发展，电话业务的适度发展和数据业务的超常发展将是未来我国电信业务市场的主要特征，电话业务由主变辅，以互联网技术为核心的数据网络将最终成为网络的主体。

《航空航天技术》基于“航天航空技术的发展显示了中国综合国力的增强”这一认识，对航空航天技术中相关领域分别进行了阐述，不仅介绍了太阳系的成员，探索了外层空间，阐述了飞机的制造，更展望了航空航天技术的发展。

《生物工程与医学》涵盖了人类基因工程、人类基因组数据、人工制造血管、超级人造细胞、干细胞、人类寿命、遗传、克隆等生物技术知识，并分析了进餐时间与人体生物钟的关系，人寿保险与社会的关系，癌症药物的新来源以及过敏、精神分析、肥胖症和糖尿病等社会医学问题，全面概述了生物与医学等方面的知识。

《人工智能》讲述了人工智能理论的原理，人类智能与机器之间的关系，人工智能、逻辑推理计算机、模糊计算机和神经网络计算机之间的关系以及人工智能技术开发、人工生命研究、机器人等

知识，能够帮助读者获得有关人工智能各个方面的最新技术发展情况。

通过对丛书的阅读，我们不仅希望能使读者对相关领域内的常用科技英语词汇、术语有一个全面的初步印象，还想借此机会能够让大家进一步了解到科技的发展现状与趋势，从而为大家在具体研究中起到一定的帮助作用。

如果您看完本书后觉得物有所值，能使您的知识有所增长，那就是我们最大的欣慰了。由于时间仓促，作者水平有限，书中难免存在疏漏与不足之处，还望各位专家读者不吝赐教，以便我们修订再版时予以订正。

编者

2003.05

内容简介

人工智能主要研究用人工的方法和技术，模仿、延伸和扩展人的智能，实现机器智能。有人把人工智能分成符号智能和计算智能两类。符号智能是以知识为基础，通过推理进行问题求解，即所谓的传统人工智能。计算智能是以数据为基础，通过训练建立联系，进行问题求解，如人工神经网络、遗传算法、进化程序设计、人工生命等。本书比较全面地介绍了以上有关人工智能的知识，各章均采用英文原文，并配以中文技术背景、单词注释和句子注释以方便读者阅读。文章浅显生动，知识严谨，适合各类读者。

本书可作为高等院校控制工程与计算机等相关专业师生的科技英语学习指导书，也可作为科研人员和专业人士进行科技英语学习的参考书。

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Chapter1 Introduction(1)

人工智能简介(1)

【原文】

This is my first article on artificial intelligence written for people in the age group of 15 to 25. This is the first and introductory article on artificial intelligence, which is part of a whole series that I will write. Excuse my mistakes, because I am not used to writing articles for people to read. All traditional articles would start with the question"What is artificial intelligence"and then its definition. Here I will not define artificial intelligence in the beginning causing you to confuse yourself. If any of you have seen movies like War Games, 2001: A Space Odyssey, Star Wars, etc, you may have seen robots and machines, which talk with people, understand human language, etc. These machines are examples of artificial intelligence. All these robots are fictitious and don't exist in the time and space that we live in. But is it possible to make such machines? To know this, we must understand the essential difference between a machine and the human brain.

The human brain consists of millions of neurons【1】, which are thousands of times slower than the logic gates of computers. Hence, computers perform calculations for which they have been programmed extremely fast. But try asking a computer to write poetry, ask it whether it likes you or anything that you would ask a person or any other human being. The computer would idiotically reply the

user has given it invalid input(how insensitive). This is where artificial intelligence comes in. This is where I will define artificial intelligence. Artificial intelligence is a system, which tries to emulate human intelligence within a computer, and gives the feeling of intelligence to the user. The computer doesn't have to be really intelligent or it doesn't necessarily have to understand what is happening. As long as the user feels that it is intelligent, it is called artificial intelligence. Hence, artificial intelligence isn't necessarily intelligent but emulation of intelligence. (1)

So why do you have to read this dumb article written by a dumb person on artificial intelligence? What does artificial intelligence have to do with you? For this, you must show some REAL intelligence and creativity and imagine your own computer talking to you just as a robot would. You can just tell it how to solve some mathematical problems, give it some examples, and after that it starts solving them without anyone programming it to do so. Think of a machine which will learn from its mistakes, have sensitiveness, and other human qualities. Think of your refrigerator telling you to get some more eggs because some guests are coming over, and the eggs already in the fridge are not enough. This is a very short article. Its motive is to motivate you to get interested and involved in artificial intelligence.

Basic Questions

Q. What is artificial intelligence?

A. It is the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically

observable.

Q. Yes, but what is intelligence?

A. Intelligence is the computational part of the ability to achieve goals in the world. Varying kinds and degrees of intelligence occur in people, many animals and some machines.

Q. Isn't there a solid definition of intelligence that doesn't depend on relating it to human intelligence? (2)

A. Not yet. The problem is that we cannot yet characterize in general what kinds of computational procedures we want to call intelligent. We understand some of the mechanisms of intelligence and not others.

Q. Is intelligence a single thing so that one can ask yes or no for a question: Is this machine intelligent or not?

A. No. Intelligence involves mechanisms, and AI research has discovered how to make computers carry out some of them and not others. If doing a task requires only mechanisms that are well understood today, computer programs can give very impressive performances on these tasks. (3) Such programs should be considered somewhat intelligent.

Q. Isn't AI about simulating human intelligence?

A. Sometimes but not always or even usually. On the one hand, we can learn something about how to make machines solve problems by observing other people or just by observing our own methods. On the other hand, most work in AI involves studying the problems the world presents to intelligence rather than studying people or animals. AI researchers are free to use methods that are not

observed in people or that involve much more computing than people can do.

Q. What about IQ? Do computer programs have IQs?

A. No. IQ is based on the rates at which intelligence develops in children. It is the ratio[2]of the age at which a child normally makes a certain score to the child's age. The scale is extended to adults in a suitable way. IQ correlates well with various measures of success or failure in life, but making computers that can score high on IQ tests would be weakly correlated with their usefulness. For example, the ability of a child to repeat back a long sequence of digits correlates well with other intellectual abilities, perhaps because it measures how much information the child can compute with at once. However, digit span is trivial for even extremely limited computers. (4) However, some of the problems on IQ tests are useful challenges for AI.

Q. What about other comparisons between human and computer intelligence?

A. Arthur R. Jensen , a leading researcher in human intelligence, suggests as a heuristic hypothesis[3] that all normal humans have the same intellectual mechanisms and that differences in intelligence are related to quantitative biochemical [4] and physiological conditions[5]. I see them as speed, short term memory, and the ability to form accurate and retrievable long term memories.

Whether or not Jensen is right about human intelligence, the situation in AI today is the reverse.

Computer programs have plenty of speed and memory but their

abilities correspond to the intellectual mechanisms that program designers understand well enough to put in programs. Some abilities that children normally don't develop till they are teenagers may be in, and some abilities possessed by two year olds are still out. The matter is further complicated by the fact that the cognitive sciences still have not succeeded in determining exactly what the human abilities are. Very likely the organization of the intellectual mechanisms for AI can usefully be different from that in people.

Whenever people do better than computers on some tasks or computers use a lot of computation to do as well as people, this demonstrates that the program designers lack understanding of the intellectual mechanisms required to do the task efficiently.

Q. When did AI research start?

A. After WWII, a number of people independently started to work on intelligent machines. The English mathematician Alan Turing may have been the first. He gave a lecture on it in 1947. He also may have been the first to decide that AI was best researched by programming computers rather than by building machines. By the late 1950s, there were many researchers on AI, and most of them were basing their work on programming computers.

Q. Does AI aim to put the human mind into the computer?

A. Some researchers say they have that objective, but maybe they are using the phrase metaphorically. The human mind has a lot of peculiarities, and I'm not sure anyone is serious about imitating all of them.

Q. What is the Turing test?

A. Alan Turing's 1950 article Computing Machinery and Intelligence discussed conditions for considering a machine to be intelligent. He argued that if the machine could successfully pretend to be human to a knowledgeable observer then you certainly should consider it intelligent. (5) This test would satisfy most people but not all philosophers. The observer could interact with the machine and a human by teletype(电报机) (to avoid requiring that the machine imitate the appearance or voice of the person), and the human would try to persuade the observer that it was human and the machine would try to fool the observer.

The Turing test is a one－sided test. A machine that passes the test should certainly be considered intelligent, but a machine could still be considered intelligent without knowing enough about humans to imitate a human.

Daniel Dennett's book Brainchildren has an excellent discussion of the Turing test and the various partial Turing tests that have been implemented, i.e. with restrictions on the observer's knowledge of AI and the subject matter of questioning. It turns out that some people are easily led into believing that a rather dumb program is intelligent.

Q. Does AI aim at human－level intelligence?

A. Yes. The ultimate effort is to make computer programs that can solve problems and achieve goals in the world as well as humans. However, many people involved in particular research areas are much less ambitious.

Q. How far is AI from reaching human－level intelligence?

When will it happen?

A. A few people think that human – level intelligence can be achieved by writing large numbers of programs of the kind people are now writing and assembling vast knowledge basis of facts in the languages now used for expressing knowledge.

However, most AI researchers believe that new fundamental ideas are required, and therefore it cannot be predicted when human level intelligence will be achieved.

Q. Are computers the right kind of machine to be made intelligent?

A. Computers can be programmed to simulate any kind of machine.

Many researchers invented non – computer machines, hoping that they would be intelligent in different ways than the computer programs could be. However, they usually simulate their invented machines on a computer and come to doubt that the new machine is worth building. Because many billions of dollars have been spent in making computers faster and faster, another kind of machine would have to be very fast to perform better than a program on a computer simulating the machine.

Q. Are computers fast enough to be intelligent?

A. Some people think much faster computers are required as well as new ideas. My own opinion is that the computers of 30 years ago were fast enough if only we knew how to program them. Of course, quite apart from the ambitions of AI researchers, computers will keep getting faster.

Q. What about parallel machines?

A. Machines with many processors[6] are much faster than single processor can be. Parallelism itself presents no advantages, and parallel machines are somewhat awkward to program. When extreme speed is required, it is necessary to face this awkwardness.

Q. What about making a child machine that could improve by reading and by learning from experience?

A. This idea has been proposed many times, starting in the 1940s. Eventually, it will be made to work. However, AI programs haven't yet reached the level of being able to learn much of what a child learns from physical experience. (6) Nor do present programs understand language well enough to learn much by reading.

Q. Might an AI system be able to bootstrap itself to higher and higher level intelligence by thinking about AI?

A. I think yes, but we aren't yet at a level of AI at which this process can begin.

Q. What about chess?

A. Alexander Kronrod, a Russian AI researcher, said Chess is the Drosophila of AI. He was making an analogy with geneticists' [7]use of that fruit fly to study inheritance. Playing chess requires certain intellectual mechanisms and not others. Chess programs now play at grandmaster level, but they do it with limited intellectual mechanisms compared to those used by a human chess player, substituting large amounts of computation for understanding. Once we understand these mechanisms better, we can build human – level chess programs that do far less computation than do present pro-