Institute for Theoretical Computer Science

China Computer Science Vision 2020

Andrew Chi-Chih Yao (Ed.)

Tsinghua University Press

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藏书章

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Beijing

China Computer Science Vision 2020 Committee have invited many of the leading computer scientists to give lectures on their perspectives on the state of the art of computer science today, and the likely future shape of computer science in ten to fifteen years. This is a great opportunity to get their experiences and advice on how to build a modern computer science department starting from the fundamentals. It is hoped that this book, besides imparting valuable scientific knowledge, will be shedding light on China's future road towards building a first-rate computer science discipline!

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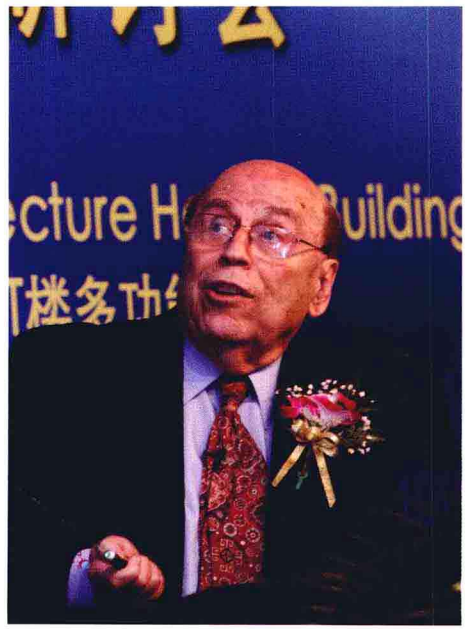

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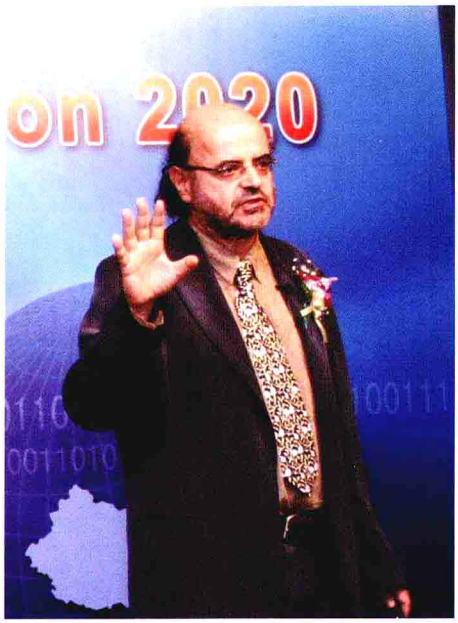

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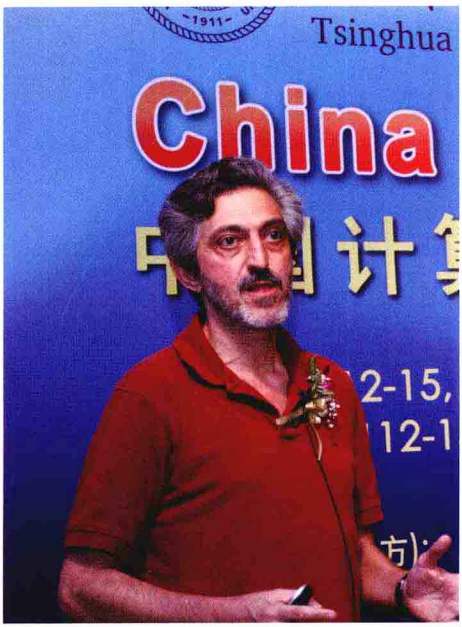

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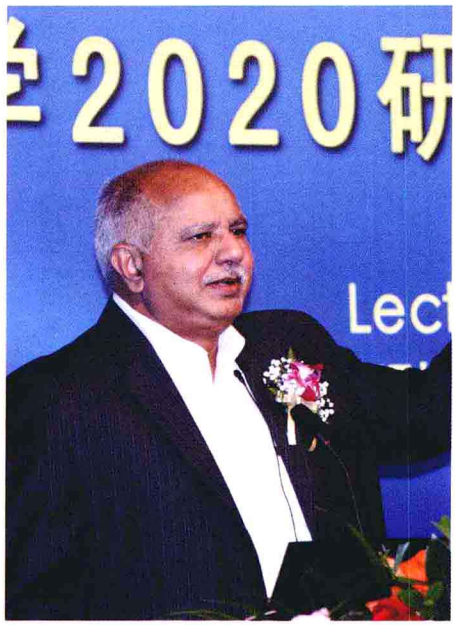

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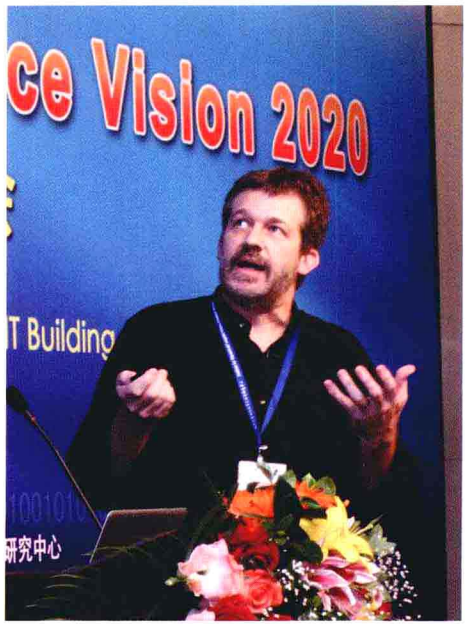

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Computer Science Vision 2020 (October 12-15, 2009)
China Computer Science Vision 2020
Lecture Hall, FIT Building

Open Forum

Foreword

The Symposium China Computer Science Vision 2020 was held during October 12-15, 2009, at the Institute for Theoretical Computer Science (ITCS) in Tsinghua University, Beijing, China.

China is striving to build first-rate research universities to go with her remarkable economic growth in recent years. After five years of first-hand experience in developing research and education programs in Tsinghua University, we have come to believe that there is a real chance to successfully build a first-rate computer science discipline in China within ten to fifteen years. This task no doubt would be a great challenge, but at the same time it presents a rare opportunity to design a brand new computer science institute that would meet the needs of the computer science for tomorrow's world.

In China Computer Science Vision 2020, we have invited many of the leading computer scientists to give lectures on their perspectives on the state of the art of computer science today, and the likely future shape of computer science in ten to fifteen years. This has also been a great opportunity for us to hear their experiences and advice on how to build a modern computer science department starting from the fundamentals. This symposium, besides imparting valuable scientific knowledge, has been shedding light on China's future road towards building a first-rate computer science discipline.

Andrew Chi-Chih Yao
Director, ITCS
Tsinghua University

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China Computer Science Vision 2020

Prof. Andrew Yao

Tsinghua University

Director of Institute for Theoretical Computer Science

2000 A.M. Turing Award
1996 Donald E. Knuth Prize
1987 George Polya Prize
Member of US National Academy of Sciences
Fellow of the American Academy of Arts and Sciences
Foreign Member of Chinese Academy of Sciences

Chair:
China Computer Science Vision 2020

清華大學 Tsinghua University

iTcs Institute for Theoretical Computer Science

Opening Remark

Andrew Chi-Chih Yao

What I would like to do in the next few minutes is to give you some background for the holding of China Computer Science Vision 2020.

I was born in Shanghai, China. I went to the United States at the age of 21 for graduate study. And afterwards I worked there and have been teaching in many leading universities for more than 30 years. In 2004, I returned to China, and started working at Tsinghua University. And at that time, China has already made a determination to build world-class universities. So the question is: can China build world-class universities within a relatively short time? I was greatly excited by that prospect. And so when Tsinghua University invited me to return to China, I gladly accepted. As a computer scientist, the question that I faced was that can China build first-rate computer science departments within decades? Tsinghua University has been enormously supportive of my work and the initial goal that I set for myself is two folds: one, build an elite undergraduate computer science class and a good PhD program in my own special research area; and number two, build a research center of excellence in theoretical computer science, which is my specialty.

After five years, we have built a thriving theoretical computer science institute and it supports a very good undergraduate special program called CS Pilot Class and a very good PhD program with excellent students coming out of it. Broadly speaking, we have initially accomplished the initial goal that we've set for ourselves. During these five years, we have accumulated a lot of insights and

experience of building education and research programs in China. So this is a good time for us to reflect and to contemplate what can be accomplished in the next ten years.

As an academic professor, it is exciting to build first-rate universities in any place at any time. However, building first-rate universities in China at this time, is not purely an intellectual pursuit, but is actually important through the continuing economic growth of China. Information technology has been a crucial sector for economics in the last four decades. And the information technology market of China is not small any more, however, for the next ten years, by the year 2020, the information technology market of China is expected to grow enormously. We all know that having first-rate computer science departments are very important to the economic growth and innovation of technology in information technology. And so the time is the essence. There is urgency in building first-rate computer science departments to help the Chinese industries innovative and competitive at high end. So in other words, China really has to have its own Silicon Valley.

Therefore, on this occasion, I would like to propose a broad plan, which we call China Computer Science 2020 Plan, so that we will be able to build first-rate computer science departments by the year 2020. This plan is in some sense general. However, I am going to discuss it within a personal context, with the environment that I am familiar with. So that what I propose we can do is to build the institute we have right now, the ITCS, into a medium sized computer science institute, not just theory, but for general computer science. So the plan is that it should cover a substantial part of computer science. So what we would like to achieve by 2020 is to have academic excellence so that it would be competitive with the top ten computer science departments in the world. And we would also like to help make China competitive in tomorrow's IT innovation. This would involve for example, nurturing innovative computer science students and talents at all levels and creating high-end intellectual properties by our faculty and our researchers, and promoting technology transfer, so in other words, what is Stanford University or MIT or Princeton University are doing at this time.

Concretely for the next five years, as the first phase, we would build up in five strategic areas starting from the areas we have strength in, and gradually encompass other areas. And we would like to recruit computer science talents anywhere in the world. The expectation is that by the end of five years, we should have 6 faculty

members in each area, a mixture of junior and senior faculty members. So altogether 30 faculty members in total by 2015. And approximating that each faculty would take 4 PhD students caring at any time, so that would be 120 PhD students at any one time. And so here is a tentative rough plan of the areas that we think we should build up in the next five years. Currently we have expertise in algorithms and complexity, and in mathematical tools. These areas are particularly important, and also have the characteristics that they would acquire a lot of thinking and techniques.

After that the next five years, in other words by the year 2020, we would expand this to ten areas with 60 faculty members and 240 PhD graduate students at any one time.

Now let's examine whether this is a realistic goal or not. Firstly, it is a feasible goal because there are many people who have done it before. For example, Princeton has a computer science department established in 1985 with 7 faculty members. And within 6 years by the year 1993, it is expanded, I think, and doubles to about 16 faculty members. And in the 1993, survey by the NRC ranking, Princeton was listed at the No. 6 in the computer science departments. And also notice that Princeton started out with an almost purely theoretical bents, all the existing faculties at that time and also the senior people recruited at that time were all theories. Therefore, it really shows it doesn't have to expand all the areas all at once, but started concentrated on some strong areas than maintaining the category of excellence and gradually expanding to all the areas. Now Princeton Computer Science Department is not only a theory department. It has strength in many many areas with many many intellectual properties. And many people have started out companies. So it is a successful story we can take care from. And also there are other examples like the Georgia Tech, which has built as a great engineering school, an institute in environment energy in just five years, and so these are really good examples that we can learn from. And that these are examples that are feasible. Let me also say that there is a current perception that it is much easier to build excellent departments and universities in the United States than in China. After five years, after thinking about it deeply, I would say that the converse is true. I think China has a lot of advantages. So that I believe that in China today, it is easier to recruit talents and build strong departments than in the United States. And that is why I think it is entirely feasible of the 2020 Plan.

Let me also take a look at the financial aspects. I think everyone knows that building

universities are expensive, but I think that you should look at it from a different point of view. In Hong Kong, the departments of computer science typically have 30 faculty members. So for the next five years, if we develop into 30 faculty members, then the cost of maintaining the department of that size is no more than that of a typical computer science department in Hong Kong. And certainly if Hong Kong can afford it, Beijing or Shanghai can afford it too. And to come back to an early point, I think this task to build a first-rate computer science department by 2020 is not only feasible, but actually is compulsory. There is a window of opportunity for us to build a strong Silicon Valley in China, so that we can take advantage of the enormous growth of the IT technology in China. And the cost of inaction is enormous indeed.

And now I have finished this long digression and come back to the purpose of this symposium.

Of course, at any time, it is wonderful to have friends and colleagues gather together and talk about their favorite subjects. So the first purpose is to have a look at cross section of the state of the art of computer science today. At the same time, we would have a chance to have a glimpse of the future shape of computer science in the next decades. And finally there is a special purpose here, namely that, we will have a chance to get advice and ideas from these world famous experts in computer on how to build a modern computer science discipline starting from scratch. So we have a chance to talk more about this topic in the end of this symposium when we have a forum discussion.

Thank you very much!

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