# Tsinghua
# Newsletter

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China-Italy Design Innovation Hub Launch Ceremony and China-Italy Design Innovation Day held

Winner of Lui Che Woo Prize, Xie Zhenhua, donates prize money to Tsinghua

清华大学
Tsinghua University

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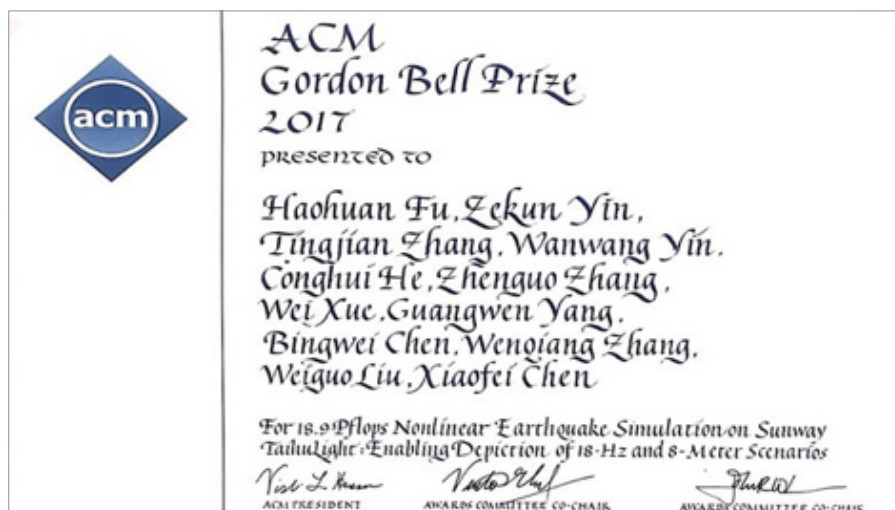
**A**CM named a 12-member Chinese team, five of whom are from Tsinghua University, as the recipients of the 2017 ACM Gordon Bell Prize, for their research project, "18.9-Pflops Nonlinear Earthquake Simulation on Sunway TaihuLight: Enabling Depiction of 18-Hz and 8-Meter Scenarios." Using the Sunway TaihuLight, which is ranked as the world's fastest supercomputer, the team developed software that was able to efficiently process 18.9 Pflops (or 18.9 quadrillion calculations per second) of data and create 3D visualizations relating to a devastating earthquake that occurred in Tangshan, China, in 1976. This is the second time that the prize has been given to a Chinese research team.

The ACM Gordon Bell Prize tracks the progress of parallel computing and rewards innovation in applying high performance computing to challenges in science, engineering, and large- scale data analytics. The award was presented by ACM President Vicki Hanson and Subhash Saini, Chair of the 2017 Gordon Bell Prize Award Committee, during the International Conference for High Performance Computing, Networking, Storage and Analysis (SC17) in Denver, Colorado on November 17th, Beijing Time.

Although earthquake prediction and simulation is an inexact and emerging area of research, scientists hope that the use of supercomputers, which can process vast sets of data to address the myriad of variables at play in geologic events, may lead to better prediction and preparedness. For example, the Chinese team's 3D simulations may inform engineering standards for buildings being developed in zones known to be prone to earthquakes. In this vein, many have advocated for a significant increase in the amount of sensors to regularly monitor seismic activities. The Tangshan earthquake, which occurred on July 28, 1976 in Tangshan, Hebei, China, is regarded as the most devastating earthquake of the 20th century. In developing their simulations for the Tangshan earthquake, the winning team included input data from the entire spatial area of the quake, a surface diameter of approximately 320 km, as well as 40 km deep below the Earth's surface. The input data also included a frequency range of the earthquake of up to 18 Hz (Hertz). In the study of earthquakes, a Hertz is a unit of measurement that measures the number of times an event happens in the period of a second. For example, it might correspond to the number of times the ground shakes back and forth during an earthquake. Previous simulations of violent earthquakes have employed a lower frequency than 18 Hz, since enormous memory and time of computation are needed for high frequency simulations.

This year's winning team is not the first to develop algorithms for supercomputers in an effort to simulate earthquake activity. In the abstract of their presentation, the 2017 Gordon Bell recipients wrote: "Our innovations include: (1) a customized parallelization scheme that employs the 10 million cores efficiently at both the process and thread levels; (2) an elaborate memory scheme that integrates on-chip halo exchange through register communication, optimized blocking configuration guided by an analytic model, and coalesced DMA access with array fusion; (3) on-the-

fly compression that doubles the maximum problem size and further improves the performance by 24%."

Of its new innovations, the Chinese team adds that its on-the-fly compression scheme may be effectively applied to other challenges in exascale computing. In their paper, the authors state: "The even more exciting innovation is the on-the-fly compression scheme, which, at the cost of an acceptable level of accuracy lost, scales our simulation performance and capabilities even beyond the machine's physical constraints. While the current compression scheme is largely customized for our specific application and the Sunway architecture, we believe the idea has great potential to be applied to other applications and other architectures."

The first author of the paper is Haohuan Fu, Associate Professor in the Department of Earth System Science, Tsinghua University and the National Supercomputing Center,
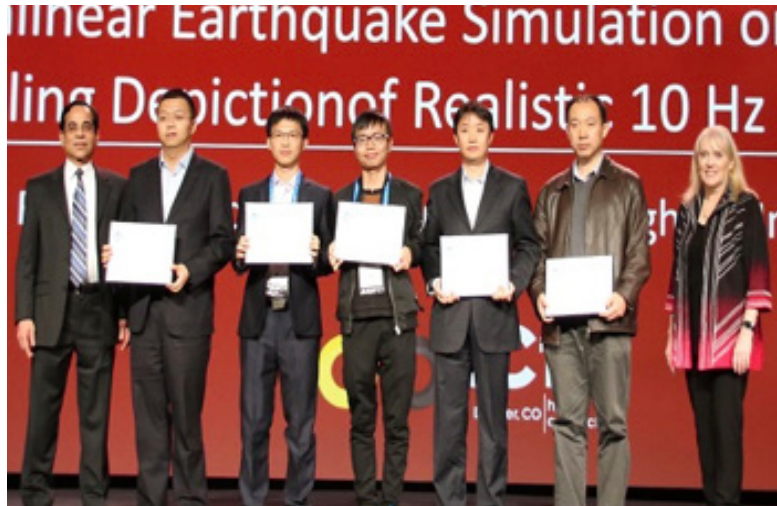


Wuxi, China. The co-corresponding authors include Haohuan Fu, Conghui He, and Wei Xue, from Tsinghua University and the National Supercomputing Center, and Xioafei Chen, from the Southern University of Science and Technology, China. Other authors include Bingwei Chen, Tsinghua University and the National Supercomputing Center; Zekun Yin, Shandong University; Zhenguo Zhang, Southern University of Science and Technology, China; Wenqiang Zhang, University of Science and Technology of China; Tingjian Zhang and Weiguo Liu, Shandong University; Wanwang Yin, the National Research Center of

Parallel Computer Engineering and Technology, China; and Guangwen Yang, Tsinghua University and the National Supercomputing Center.

This research project was jointly completed by the Department of Earth System Science and the Department of Computer Science and Technology, Tsinghua University, together with Shandong University the Southern University of Science and Technology, the University of Science and Technology of China, the National Research Center of Parallel Computer Engineering and Technology, China, and the National Supercomputing Center, Wuxi, China.

Innovations from advanced scientific computing have a far-reaching impact in many areas of science and society—from understanding the evolution of the universe and other challenges in astronomy, to complex geoscience phenomena, and to nuclear energy research, economic forecasting, and the development of new pharmaceuticals. The annual SC conference brings together scientists, engineers and researchers from around the world for an outstanding week of technical papers, timely research posters, and tutorials.

The Sunway TaihuLight is a Chinese supercomputer operated by Tsinghua University with over 10.5 M heterogeneous cores and has been ranked as the fastest supercomputer in the world since 2016. Located at the National Supercomputer Center in Wuxi, Jiangsu, China, it is nearly three times as fast as the Tianhe-2, the previously fastest supercomputer in the world.
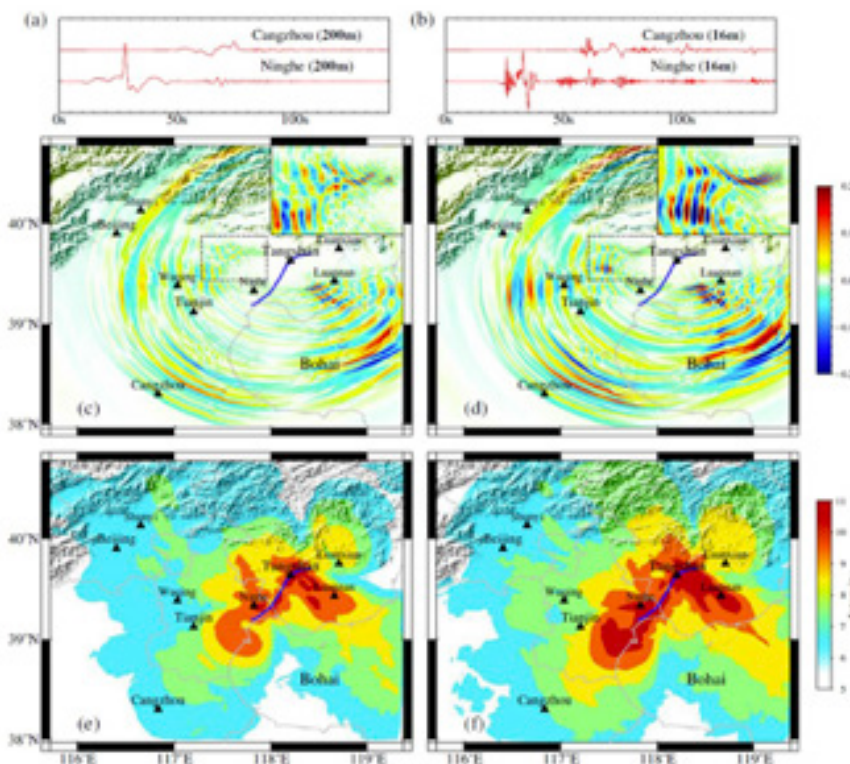
# China-Italy Design Innovation Hub Launch Ceremony and China-Italy Design Innovation Day held



On November 13th, the China-Italy Design Innovation Hub launch ceremony and China-Italy Design



Innovation Day, hosted by Tsinghua University and the Politecnico di Milano, and organized by Tsinghua's Academy of Arts & Design together with TUS-Holdings Co., Ltd., took place at the Academy of Arts & Design, Tsinghua University. Experts and scholars in the domain of design and innovation from both China and Italy attended the ceremony, and together witnessed the launch of the Innovation Hub as well as the unveiling of Tsinghua Arts and Design Institute in Milan.

In February 2017, witnessed by President Xi Jinping of China and President Sergio Mattarella of Italy,

Qiu Yong, the President of Tsinghua University, and Mr. Ferruccio Resta, Rector of the Politecnico di Milano, signed an agreement in the Great Hall of the People in Beijing, setting forth their joint intention of establishing the China-Italy Design Innovation Hub in the city of Milan. This event promoted and deepened, in a practical manner, Sino-Italian innovation and cooperation, and facilitated the further development of

design and innovation in both countries.

Among the attendees of the ceremony were Mrs. Valeria Fedeli, Minister of Education, University and Research of Italy, Mr. Ettore Francesco Sequi, the Italian ambassador to China, Mr. Ferruccio Resta, Rector of the Politecnico di Milano, the President of Tsinghua University Qiu Yong, Mr. Cao Guoying, the Deputy Director General of the Department

of High-tech Development and Industrialization of the Ministry of Science and Technology, and Mr. Deng Wei, Vice Chairperson of the University Council of Tsinghua.

In his speech, President Qiu stated that Tsinghua first released its global strategy in 2016, and the China-Italy Design Innovation Hub is a very important part of this strategy. The hub is Tsinghua's first educational and research base in Europe, which will build upon the advantages of both universities in the fields of arts and design to focus on establishing an integrated platform of talent training and innovation which academic circles, governments and industries of both China and Italy can participate in. The China-Italy Design Innovation Hub will promote communication and collaboration between both countries in education, scientific research, and the cultural industries.

Regarding the cooperation between Tsinghua and the Politecnico di Milano, Rector Resta noted that the Politecnico di Milano has made progress in terms of international cooperation and is open to communicate and work with other universities. Tsinghua is a dream partner for the Politecnico di Milano. It marks a significant cooperation between the two universities.

As another milestone in Sino-Italian scientific innovation and collaboration, the launch of the China-Italy Design Innovation Hub signifies that Tsinghua, after the establishment of the Global Innovation eXchange (GIX), has made the university closer to its goal of becoming




a more innovative, more internationalized, and more humanity-oriented university. This innovation hub will have the training of talents at its core, and will make itself a globally influential institution in design and innovation with the joint support of Tsinghua's Academy of Arts & Design and the Politecnico di Milano. By means of its innovative mode of governance and operational mechanisms, and its close ties with related industries, the China-Italy Design Innovation Hub will help with the transition and upgrading of Chinese manufacturing, make an active contribution to Sino-Italian educational, scientific and cultural exchanges, and thereby serve "The Belt and Road Initiative".

Mrs. Valeria Fedeli extended her best wishes to both universities on behalf of the Italian government, and stated in her speech that the establishment of the China-Italy Design Innovation Hub signifies a great step forward jointly made by China and Italy in scientific and technological cooperation.

Mr. Cao Guoying noted in his speech that the China-Italy Design Innovation Hub will make a contribution to the training of talents in design, discipline development, the transformation of scientific and technological achievements, and incubating businesses.

Apart from the launch of the hub, the unveiling ceremony of Tsinghua Arts and Design Institute in Milan was held at the same time. This institute will integrate the leading disciplines of the Tsinghua's Academy of Arts & Design and the other excellent educational resources of both China and Italy to undertake teaching and research in Milan.

The cooperative Partnership signing ceremony of the Base for Cooperation with Government of the China-Italy Design Innovation Hub was held the same day.

# Yigong Shi's Group publishes an article in *Cell,* reporting the cryo-EM structure of the post-catalytic spliceosome from Saccharomyces cerevisiae

On November 17th 2017, Professor Yigong Shi's group in the School of Life Sciences, Tsinghua University, published an article entitled "Structure of the Post-catalytic Spliceosome from Saccharomyces cerevisiae" in the prestigious research journal *Cell*. The paper reported the cryo-EM structure of post-catalytic spliceosome, a crucial complex for RNA splicing in Saccharomyces cerevisiae, at the average resolution of 3.6 angstrom. This structure illustrates

the mechanism of spliceosome remodeling after RNA splicing reaction and 3'-splice site (3'SS) recognition. This high resolution structure reveals unexpected features of the 3'SS recognition during the second-step RNA splicing reaction, the transesterification occurred in the second step and the release of the mature mRNA.

In 1977, scientists found that adenovirus mRNA could not form a continuous double-stranded RNA-DNA hybridization duplex with its corresponding DNA transcription template for the first time. Instead, single-stranded DNA bulges were extended at different positions in the hybridized double-stranded RNA-DNA duplex. This important result showed that the transfer of genetic information from DNA to mRNA not only involved transcription but also pre-mRNA splicing, which is to further remove "useless" genetic information and connect useful genetic information. "Useless" genetic information, which is called the intron, cannot be translated, and the useful genetic information which can be translated by ribosome is called the exon. RNA splicing widely exists in eukaryotes, the average number of introns per gene increases as one looks from simple single-celled eukaryotes, such as yeast, through higher organisms such as worms and flies, all the way up to humans. Some pre-mRNAs can be spliced in more than one way. Thus, mRNAs containing different selections of exons can be generated from a given pre-mRNA. Called alternative splicing, this strategy enables a gene to give rise to more than one polypeptide product.

Splicing of pre-messenger RNA (pre-mRNA) is an important and



**Figure 1. A cartoon diagram of RNA splicing.**
(Shi Y. Nature Reviews Molecular Cell Biology, 2017.)

complicated step of central dogma in eukaryotic cells. This process is accomplished by a dynamic mega-complex known as the spliceosome. From the discovery of RNA splicing in 1977 to the beginning of this century, scientists initially established the process of assembly and disassembly of the spliceosome by immunoprecipitation, gene knock-

out, cross-linked mass spectrometry, and in vitro splicing reaction and so on. During an RNA splicing reaction, an intron is removed through two successive transesterification reactions in which phosphodiester linkages within the pre-mRNA are broken and new ones are formed. To catalyze splicing of the pre-mRNA, spliceosome undergoes extremely precise stepwise assembly, subsequently forming a series of spliceosomal complexes. According to the reaction state and biochemical characterization, these complexes can be defined as tri-snRNP, B, Bact, B*, C, C*, P, and ILS complexes (Figure 1).

Post-catalytic spliceosome (P complex) is a highly dynamic and transient state and is difficult to



**Figure 2. Structure of the Post-catalytic Spliceosome, Known as the P Complex, from S. cerevisiae.**

purify under normal physical conditions. In their recent Cell paper, Shi and colleagues enriched P complex samples in S.cerevisiae cells through over-expression of an ATPase-defective Prp22 mutant, leading to the inhibition of mature mRNA release in vivo. Then they acquired a good P complexes sample by applying TAP purification strategy and determined the three-dimensional structure of post-catalytic spliceosome (P complex) at the overall resolution of 3.6 angstrom by single particle cryo-EM, and built the atomic model (Figure 2). This structure displays the overall structure of the spliceosome and the organization of spliceosomal protein and RNA components after the two-step transesterification reactions during RNA splicing. In this structure, we can clearly see the two exons, which is separated by an intron before splicing, is covalently linked, forming a mature mRNA and anchored in spliceosomal active site through base-paring with U5 snRNA. Remarkably, this structure first reveals the recognition mechanism of

3'SS of the pre-mRNA. The dinucleotide AG at the 3'SS is separately base-paired with adenine nucleotide in BPS and the first guanine nucleotide at 5'SS, and further stabilized through stacking interaction by G of 5'SS and U6 snRNA. Therefore, this structure provides important structural evidence to illustrate the mechanism of 3'SS recognition and mRNA release by Prp22, promoting and advancing our understanding of pre-mRNA splicing.

Prof. Yigong Shi is the corresponding author. Rui Bai (PhD student from the School of Life Sciences), Dr. Chuangye Yan (postdoc fellow from the School of Life Sciences and Center for Life

Sciences), and Ruixue Wan (PhD student from the School of Medicine) are the co-first authors of this paper. Dr Jianlin Lei provided technical support on the EM data collection. EM images were acquired at the Tsinghua University Branch of the China National Center for Protein Sciences (Beijing). Data processing was performed on the "Explorer 100" cluster system of Tsinghua National Laboratory for Information Science and Technology, the Computing Platform of China National Center for Protein Sciences (Beijing). This research was funded by the Beijing Innovation Center for Structural Biology and the National Natural Science Foundation of China.

# Winner of Lui Che Woo Prize, Xie Zhenhua, donates prize money to Tsinghua

Tsinghua to promote establishment of World's First-Class Universities' Climate Change Alliance

On November 3rd, Xie Zhenhua, China's special representative on climate change and Vice Chairman of the Committee of Population, Resources and Environment of the Chinese People's Political Consultative Conference (CPPCC), attended a donation ceremony held at Tsinghua University and donated a total of 20 million Hong Kong dollars to the Tsinghua University Education Foundation. The amount donated was Mr. Xie's prize money from winning the Lui Che Woo Prize (Sustainability Prize).

Qiu Yong, President of Tsinghua University, Yang Bin, Vice President of Tsinghua University, and He Jiankun, former Deputy President of Tsinghua and Deputy Director of the National Expert Committee on Cli-

mate Change, were also present at the donation ceremony.

Xie Zhenhua said that as a Tsinghua alumnus, he was very willing to donate the prize money to his alma mater for the establishment of the "Global Climate Change and Green Development Fund", whose purpose is to support international cooperation for green and low carbon development and climate change, to facilitate related projects, and to provide scholarships for students in related disciplines. Mr. Xie hoped the donation would help with Tsinghua's execution of this relevant work and its discipline construction, and that it would strengthen exchange and collaboration between Tsinghua and the wider world, thus contributing to the building of a community of common destiny for all mankind.

In his speech, President Qiu expressed his gratitude to Xie Zhenhua on behalf of the university, and announced that Tsinghua University would set up the Institute of Research on Climate Change and Sustainable Development. In addition, Tsinghua will promote the establishment of the World First-Class Universities' Climate Change Alliance, which will give top universities a leading role in addressing global climate change.



After the donation ceremony, Mr Xie delivered a keynote speech entitled "Firm Confidence and Active Promotion of Global Climate Governance", expounding on the progress of global climate governance, the major achievements of the Paris Agreement, and China's actions and accomplishments in dealing with the climate issue.



# Four Tsinghua professors elected to the Chinese Academy of Engineering and four professors to the Chinese Academy of Sciences



On November 27th, the Chinese Academy of Engineering announced its 2017 list of newly elected academicians, which includes four Tsinghua professors and seven alumni.

The four professors are Professor Dai Qionghai from the Department

# Six Tsinghua professors and eight alumni among newly elected IEEE Fellows

Recently, IEEE, the world's largest non-profit technical professional organization, announced its list of the newly elected Fellows of 2018, which includes six professors from Tsinghua University: Shu Jiwu, Sun Hongbo, Sun Hongbin, Zhao Zhengming, Zhang Changshui, and Zhou Tong. A total of eight alumni are also on the list.

IEEE is an association designed to serve professionals involved in all aspects of the electrical, electronic, and computing fields and related areas of science and technology that underlie modern civilization, and it has become an influential international academic organization. IEEE currently has more than 400,000 members in over 160 countries. As the highest honor conferred by IEEE, an IEEE Fellowship intends to recognize those outstanding scholars who have made significant achievements in science and engineering technology.

of Automation, Professor Zhou Ji from the School of Materials Science and Engineering, Professor Zhang Jianmin from the School of Civil Engineering, and Professor Dong Jiahong from the Beijing Tsinghua Changgung Hospital.

On the following day, November 28th, a list of new members was announced by the Chinese Academy of Sciences, which also included four Tsinghua professors and four alumni.

The four professors are C.N.Yang Professor Wang Xiaoyun from the Institute for Advanced Study, Professor Chen Yeguang from the School of Life Sciences, Professor Ouyang Minggao from the Department of Automotive Engineering, and Professor Duan Wenhui from the Department of Physics.

# The first Asian Universities Alliance Executives' Meeting held at Thailand's Chulalongkorn University

On November 16th and 17th, the first Executives' Meeting of the Asian Universities Alliance (AUA), which Tsinghua University took the lead in launching, was held at Thailand's Chulalongkorn University. The Executive President of the AUA, Chulalongkorn University's President Professor Bundhit Eua-arporn, made a speech at the opening ceremony. Yuan Si, the Vice Chairperson of University Council of Tsinghua, led a

delegation to attend the meeting, during which the participants discussed the AUA Framework among other important matters.

The Founding President of the AUA, the President of Tsinghua University Qiu Yong, has sent a letter of congratulations to the meeting, cordially thanking Chulalongkorn University for hosting the first AUA Executives' Meeting, and moreover wishing the meeting great success. In the letter, Qiu Yong noted that Tsinghua, as one of the founding institutions of the AUA, had already established the AUA Secretariat and appointed a Secretary, in accordance with the stipulations of the AUA Constitution.

In President Professor Bundhit Eua-arporn's speech, he thanked Tsinghua University for taking the lead in launching the AUA, and successfully holding the AUA Summit 2017 in April. He stated that, since the AUA's establishment, every institution involved had been actively engaged, pooling resources to probe the possibility of mutually beneficial cooperative programs. The Asian Universities Alliance is becoming an important platform from which the participating institutions conduct cooperative and innovative projects and deal with common challenges.

During the meeting, nine institutions made 16 proposals, covering everything from student mobility,

academic conferences and research collaboration, to strategy and policy and more.

The delegates of the participating universities also attended the presentation of the AUA Youth Forum 2017, as well as its closing ceremony. The theme of the forum was Empowering Youth Towards Sustainability: People, Planet and Prosperity. The AUA Youth Forum 2017 took place at Chulalongkorn University from November 13th to November 17th,

having attracted more than 40 students from 14 universities in the AUA.

The Asian Universities Alliance was officially established at Tsinghua University on April 29th 2017. Vice-Premier of the State Council, Liu Yandong, attended the launching ceremony and delivered a keynote speech. The founding members of the AUA comprise 15 representative institutions from 14 countries and regions.

# Tsinghua Students Win High Distinctions at the 15th National Challenge Cup



On November 18th, the 15th National Challenge Cup came to a close at Shanghai University. In the final, the student delegation from Tsinghua University was awarded two Grand Prizes, one First Class Prize, one Second Class Prize, and two Third Class



Prizes.

The National Challenge Cup was hosted by Shanghai University this year, jointly organized by the Central Committee of the Communist Youth League, the China Association for Science and Technology, the Ministry of Education, the Chinese Academy

of Social Sciences, the All-China Students' Federation, and the Shanghai Municipal People's Government. Over 30,000 student projects participated in the preliminary round of this year's contest, of which 1,230 were selected for the national contest, and 755 were selected for the final. The students whose projects entered the final also defended their works on the spot. There were altogether 39 Grand Prizes awarded, accounting for about 5% of the entries in the final. The Tsinghua delegation, which comprised four

chosen projects, participated in the final.

The National Challenge Cup is a biennial competition for extra-curricular scientific and technological inventions. It is considered to be the largest and most influential comprehensive contest in these fields for Chinese university students, and is therefore nicknamed the "Olympiad for University Students". The inaugural National Challenge Cup was hosted by Tsinghua University in 1989, and until now there have been 15 contests held altogether.
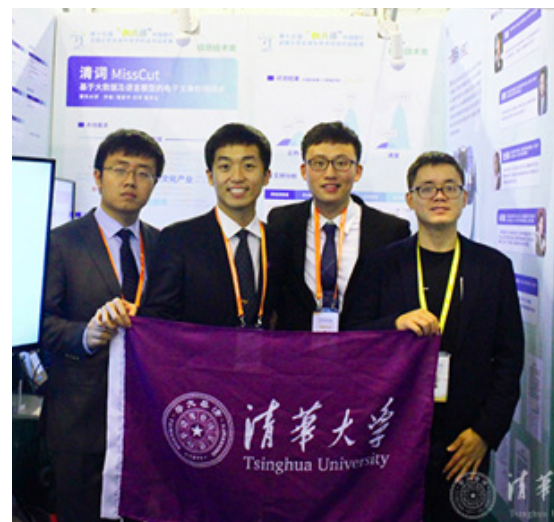


# President Qiu Yong meets with Chairman of Luksic Group

On October 31st, the President of Tsinghua University Qiu Yong met with the visiting Chairman of the Luksic Group, Andrónico Luksic, at Gongziting. Vice President Yang Bin was also present on this occasion.

At their meeting, President Qiu Yong welcomed Mr. Andrónico Luksic to Tsinghua University, and introduced him to the latest achievements of Tsinghua in the field of international development. President

Qiu noted that under the support and promotion of Mr. Luksic, Tsinghua and the Pontifical Catholic University of Chile had initiated a short-term student exchange program. Up to now, there have been more than 400 teachers and students from both universities taking part in the program, which has improved their mutual understanding. Tsinghua University looks forward to further enriching and deepening its collaborations with Chilean universities, non-governmental organizations, and local governments.

Mr. Luksic stated that the student exchange program established by Tsinghua and the Pontifical Catholic University of Chile was an embodiment of the continuous development of the friendly bilateral relation between China and Chile. As a close partner of Tsinghua in its exchange and cooperation with Chile, he and the Luksic Group will continue to strongly support collaborative proj-

ects with Tsinghua University and broaden their forms of cooperation. He is looking forward to more communication and collaboration between Tsinghua and Chilean universities as well as enterprises to promote the in-depth development of Sino-Chilean bilateral relations.

Mr. Andrónico Luksic is the Chairman of the Luksic Group and the Vice Chairman of the Banco de Chile. He also serves as a member of the advisory board of School of Economics and Management, Tsinghua University.



# Associate Professor Peng Liangrui's research group wins in ICDAR 2017 Arabic Video Text Detection and Recognition Competition
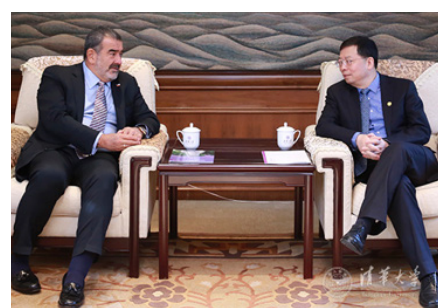
Recently, the International Conference on Document Analysis and Recognition (ICDAR 2017) was held in Kyoto, Japan. The results of the first Arabic Video Text Detection and Recognition Competition were announced, and Associate Professor Peng Liangrui together with her research group from the Department of Electronic Engineering at Tsinghua University were champions in the seven sub-tasks of text detection, and in three of the seven sub-tasks of text recognition.

ICDAR is the most important international conference in the field

of Optical Character Recognition (OCR) organized by the International Association for Pattern Recognition (IAPR) since 1993. As there are increasing research interests on Arabic video OCR, ICDAR hosted the competition on Arabic video text detection and recognition (Arabic Text Detection and Recognition in Multi-resolution Video Frames, AcTiV) for the first time. The competition was mainly organized by the University of Fribourg in Switzerland and it included two tasks ---- text detection and text recognition. The samples used in the competition covered different font types and scales, various colors, different degrees of background complexity and low resolution. Participants included Tsinghua University, the Institute of Automation of the Chinese Academy of Sciences, and the University of Sfax (Tunisia), among others.

The video text detection and recognition algorithms submitted by Peng Liangrui's research group are the latest developed methods based on deep learning. The video text detection algorithm is based on a



The ICDAR 2017 AcTiV competition award was presented to the winner by the competition organizer. From the right, the second is Dr. Peng Liangrui, and the third is PhD candidate Yan Ruijie.

convolutional neural network, and the video text recognition algorithm is based on a recurrent neural network. The students who participated in the research project include Yan Ruijie, Xiang Donglai, Wang Yaqi, Wang Xuecheng, Chen Liren and Guo Jiaming, among others. The related research was supported by the 973 National Basic Research Program of China under Grant 2014CB340506 and National Natural Science Foundation of China under Grant U1636124.

Peng Liangrui has been engaged in multi-lingual OCR research for more than ten years. Peng Liangrui's research group belongs to the Laboratory for Intelligent Image and Document Information Processing at the Department of Electronic Engineering. The laboratory has developed world-leading innovative technologies in Chinese and multilingual OCR, multi-modal biometric identification, and video surveillance.