

Profiling China's AI Unicorns:

Tang Xiao'ou, Founder of SenseTime Technology

Summary

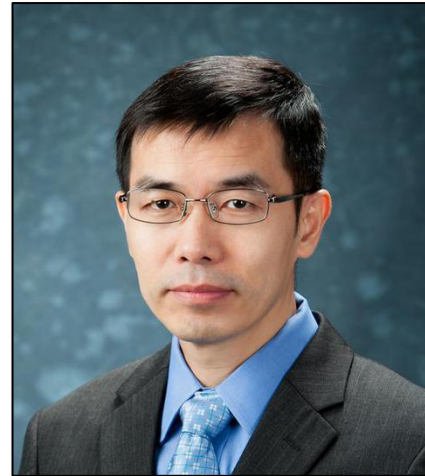
Tang Xiao'ou is the founder of SenseTime Technology, the leading Chinese developer of facial recognition technology and the richest AI “unicorn” (start-up worth a billion dollars) in the world. He is concurrently a professor of information technology at the Chinese University of Hong Kong, where he has worked in computer vision research since 1997. He is originally from mainland China, and SenseTime is headquartered in Beijing.

Tang is a graduate of MIT and worked for Microsoft in Beijing in 2005-2008. At the same time, he was running a university lab back in Hong Kong developing the AI behind facial recognition. In 2014, algorithms he developed achieved a facial recognition accuracy that exceeded human vision capabilities. He took this as a major step toward commercial use and founded SenseTime Technology to market his algorithms.

Business success came quickly as he developed identity verification systems for loan companies and smartphone-unlock software for China Mobile. Soon his technology was behind apps in the majority of Chinese smartphones. He then penetrated the financial industry using facial recognition for bank account identity verification. All the while, Tang continued to refine his facial recognition algorithms until he could claim in 2017 that they achieved an error rate of one in one hundred million attempts. SenseTime now claims some 700 customers including major Chinese firms such as Alibaba, China Mobile, Huawei Technologies, Wanda Group, Sina Weibo, Nvidia, China UnionPay, and China Merchants Bank.

Several aspects of his personality seem to play a role in the rapid rise of his fortunes. Tang Xiao'ou is an engaged scientist who has constantly pursued product improvement through scientific research. He is an astute manager of technical talent, attracting the best to his academic and commercial enterprises. He has been a successful attractor of investment from Chinese and foreign sources. He has developed and maintained a variety of strong international connections. In addition, Tang is known as a man with a sense of humor in both Chinese and English, which may be part of his attractiveness.

Tang Xiao'ou



Source: qq.com

Sources

This report is drawn primarily from information in Chinese-language media and international news coverage, profiles, interviews, and financial reports, and from English and Chinese materials available on the SenseTime website (sensetime.com).

NOTE: The name Tang Xiao'ou (汤晓鸥) is transliterated into English with an embedded apostrophe. This unusual inclusion is a standard way to clearly separate the syllables “xiao” and “ou” rather than run them together in the less readable “xiaoou.”

Profiling Tang Xiao'ou

The company that Tang Xiao'ou founded, SenseTime Technology, was summarized in a previous report. This report is intended to provide a look at Tang himself. It will cover three elements of his persona: what current positions he holds, what path led him to his current status, and what can be gleaned about his personality from this history.

Current Positions

Tang Xiao'ou holds several concurrent titles and sets of responsibilities. In the commercial world, he is primarily known for being the founder and leader of SenseTime Technology, the Beijing-based artificial intelligence and facial recognition technology developer. This is the persona he assumed when he created SenseTime in 2014.

Before that and continuing to the present, he is also Dr. Tang Xiao'ou, professor in the Department of Information Engineering and Associate Dean (for Research) of the Faculty of Engineering of the Chinese University of Hong Kong (CUHK). He is also the Director of the CUHK Multimedia Lab, the University's research base he founded in 2001 that is dedicated to the development of AI-enabled computer vision. He is an alumnus of the Massachusetts Institute of Technology with a doctorate in computer vision.

Despite working in Hong Kong since 1997, he is a mainland Chinese born in Liaoning Province who completed his education up through his bachelor's degree in mainland China. He received his undergraduate degree from the University of Science and Technology of China in Hefei in the Department of Precision Machinery and Precision Instruments.

He is the Director of the Shenzhen Advanced Technology Research Institute's Multimedia Integrated Technology Lab which he formed in 2008 as an alliance between the CUHK Multimedia Lab and the Shenzhen Institute, which is under the Chinese Academy of Sciences.

He has a long association with Microsoft, having worked in the Microsoft Research Asia lab in Beijing as manager of its Visual Computing Group from 2005 to 2008 while still holding a teaching position in Hong Kong. He reportedly registered 40 patents while working in Microsoft, and the image recognition technology that he developed with Microsoft was used in Microsoft's image search engine.

Dr. Tang is a Fellow of the international professional association, the Institute of Electrical and Electronics Engineers (IEEE). He was a program chair of the IEEE International Conference on Computer Vision (ICCV) in 2009 and has served as an Associate Editor of the IEEE journals Transactions on Pattern Analysis and Machine Intelligence (PAMI) and International Journal of Computer Vision (IJCV).

China's Minister of Science and Technology recognized Dr. Tang's achievements in 2018 by putting him at the head of the government effort to establish an "open innovation platform for next-generation AI" for intelligent vision.

His continuing links with MIT allowed him to make SenseTime the first company to participate in MIT's Intelligence Quest, whose mission is "advanced research in human and robotic intelligence for the service of all mankind." In 2018, MIT unveiled a new Intelligence Quest research plan of 27 items covering from linguistics to biophysics and other fields, all being funded by SenseTime Technology.

Tang Xiao'ou has published more than 200 academic papers and has received numerous awards. He received the Best Paper Award at the IEEE Conference on Computer Vision and Pattern Recognition (CVPR) in 2009. In 2016, SenseTime was named (along with MIT AND Stanford labs) as one of the top ten AI labs in the world. In 2018, Tang Xiao'ou was named by Tsinghua University and NetEase as one of the top ten in the annual "China AI Heroes Billboard."

Tang Xiao'ou was also recently appointed by Malaysia's Prime Minister Mahathir as Director/Trustee of the Malaysia National Sovereign Wealth Fund, the only foreigner in history in this position.

Personal History

Tang's biography as it has been covered in Chinese media or posted at CUHK has little detail about his early life other than that he was born in 1968 in Anshan, Liaoning Province, China. He entered the University of Science and Technology of China (USTC) in 1985 in its Precision Machinery and Precision Instruments Department. When he graduated in 1990, he immediately left for the United States and entered an unidentified graduate program at the University of Rochester. Once he received in master's degree there, he entered a doctoral program at MIT in 1992. No information was found to explain what resources he had available for these degree programs or how he came to be accepted into them.

His interest in AI and facial recognition started once he arrived at MIT. He was reportedly told by a professor there that facial recognition technology would become extremely useful in the future, and so his doctoral degree focus was on computer vision and pattern recognition. He also became involved in robotics development. As he tells it, "After I got to MIT I joined that lab's underwater robotics work, which used underwater video cameras equivalent to using sonar to explore the world of the sea bed. Before I left, this lab had just discovered the Titanic, so at that time I felt it was very cool."

After receiving his doctorate in 1996 he returned to China, but in 1997 he took a teaching position in the Information Engineering Department at the Chinese University of Hong Kong. While working at the university, he established the CUHK Multimedia Lab in 2001 and became its Director. Once Tang Xiao'ou formed the Lab, his team concentrated on AI and computer vision, which likely made this the first Chinese team doing research on deep learning.

Chinese University of Hong Kong



Source: iso.cuhk.edu.cn

In a couple of ways, the course of Tang Xiao'ou's career was shaped by the birth of his son in 2004. When his wife's six months of maternity leave was over, she took their son from Hong Kong back to Beijing to work and live. Tang started running back and forth between these two cities. His frequent visits to Beijing gave him opportunities to be in contact with the Microsoft Research Lab Asia (also called Microsoft Research Asia, or MSRA), and he was eventually invited in 2005 to form an alliance with Microsoft at a time when the lab was reorganizing. The new lab director Shen Xiangyang had Tang Xiao'ou take over management of his own Vision Computing Group.

In Tang's version of his history, the practical exploration of facial recognition also started with his son. He claims he felt distressed that he was missing precious moments with his son because of his shuttling in and out of Beijing for work, and he compensated by taking a huge volume of photos of the child, trying to capture each moment.

By the time the child was two years old, he had a collection of more than ten thousand baby photos. He thought he could apply the technology he was developing at work to sort through and organize the collection. "I thought that I could use facial recognition, facial analysis, use that kind of AI technology, and it could help anyone manage and arrange their albums." He used this collection he had taken of his son as an experimental data base for the Vision Computing Group. He and his assistants developed photo tagging software for the photo set, and used this image volume to

explore multiple image separation, real-time image search, implanted images, and other imaging technologies.

Tang's association with Microsoft continued through 2008. Microsoft reportedly asked Tang to stay on, but he turned them down. He shifted his work focus back to Hong Kong at the Multimedia Lab, and there he continued his development of facial recognition. It was at this point that he formed an alliance between his Multimedia Lab and the Shenzhen Advanced Research Institute. Soon after, Tang created a sensation when he teamed with Sun Jian from the Microsoft Research Asia lab and doctoral student He Kaiming to write a seminal work on AI-enabled image manipulation, "Single Image Haze Removal Using Dark Channel Prior," which won Best Article at the 2009 IEEE Computer Vision and Pattern Recognition Conference.

Tang Xiao'ou lecturing in 2010



Source: ustcif.org.cn.com

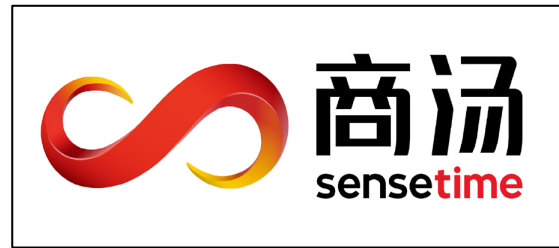
The next several years were spent honing AI processes for facial recognition, and by 2014 the Multimedia Lab had experienced some big breakthroughs. In March, Tang's team announced that their GaussianFace facial recognition algorithm had achieved an accuracy rate of 98.52 percent, exceeding for the first time the theoretical 97.53 percent accuracy of human vision. It had also beat Facebook, a key player in AI development, that had just announced that its DeepFace algorithm had an accuracy of 97.35 percent.

In early 2014, Facebook announced that its work on facial recognition had achieved this accuracy by training on a data base of 7.5 million faces. Tang and his team, using all the capital available at the moment, had only been able to put together a data base of 200,000 faces. Still, the accuracy they achieved was better than Facebook and better than human vision. Tang Xiao'ou later explained this by saying: "I would say that because our algorithm was of a better design, was smarter, we were able to use a much smaller data base and still beat them. You could say our army of 200,000 men beat their army of 7.5 million men."

Tang saw this as 'breaking through a red line' in AI technology, an achievement that would allow the commercial application of his algorithms. This drew the attention of the Chinese investment organization IDG Capital, which, seeing the commercial potential themselves, provided some of millions of dollars of angel investment to support this endeavor. In October 2014, SenseTime was founded out of personnel from the Multimedia Lab.

The company name SenseTime in Chinese was written as Shang Tang (商汤), characters that might literally be read as “Business Tang,” thus emblematic of the commercialization of the Tang Xiao’ou research effort. Hong Kong media reporting gave a more nuanced interpretation: “The Hong Kong-based startup isn’t shy about flaunting its Chinese identity. SenseTime, or Shang Tang, shares its name with the first king of the Shang dynasty, an era beginning in around 1600 BC that saw rapid development in the country. As cofounder Tang Xiao’ou explained to the MIT Technology Review, ‘China was leading the world [at that time]... And in the future, we will lead again with technological innovations.’”

SenseTime’s logo

Source: [sensetime.com](https://www.sensetime.com)

For a start-up, SenseTime began attracting business in a hurry. Its initial commercial success came in 2015 at a time when peer-to-peer lending was becoming popular in China but had identity verification problems. SenseTime came up with an application that used face scans for identity combined with motion for “liveness detection,” confirming that there was a live person being scanned. They concluded a deal with one lending customer that proved successful, and other lending companies started lining up.

In 2015 SenseTime also won a request for bids by China Mobile, the leading smartphone network in China. The Tang Xiao'ou team excelled at deep learning network design, and China Mobile possessed a large volume of complex scene user data. The Chinese media description of this partnership was that each side drew on the other's strengths. Soon after, SenseTime received an invitation from the Bank of China, and Tang went to Nanjing to introduce the potential utility of AI to the financial industry.

The record of academic articles and patents with Tang’s name on them shows that while gaining a foothold in the commercial world, SenseTime continued technological development of its AI-enabled systems. Tang highlighted the continued focus on facial recognition accuracy: “In 2016 we used 60 million faces for training and achieved an error rate of one in a million. In 2017 we used 2 billion faces for training and achieved an error rate of one in a hundred million. [Applications with] this kind of error rate could be used by any industry including monitoring and control, finance, security, and cell phones.”

By the end of 2019, SenseTime claimed it had more than 700 customers and partners in China and overseas. The list of their biggest customers includes Alibaba, China Mobile, Huawei Technologies, Wanda Group, Sina Weibo, HNA Group, Meitu, Nvidia, China UnionPay, JD Finance, China Merchants Bank, Oppo, Vivo, Xiaomi, Qualcomm, and Honda.

SenseTime is more than just another Chinese success story: it is one of the richest of the Chinese tech start-ups and the number-one AI unicorn in the world with a valuation rated at \$4.5 billion in 2019. (CEO Xu Li has claimed that SenseTime was worth more than \$7 billion.) Over \$3 billion of its value has come from successful investment calls rather than profits from revenue. SenseTime got its start with Chinese private investment money from IDG Capital, StarVC, and CDH. However, it has also attracted investment from foreign sources like Qualcomm, Fidelity International, Silver Lake, Tiger Global and SoftBank. In effect, these investors have pumped up SenseTime's valuation by betting on its future revenue and growth.

Aspects of Tang's Persona

Tracing his history and the roles he has played in SenseTime and at CUHK, some aspects of his personality can be gleaned. These may be seen at least in part as keys to his success.

Tang Xiao'ou is an engaged scientist. He is not some 23-year-old start-up sensation with a clever idea. He is a professor of information engineering who spent 11 years in universities up to and including MIT to develop his knowledge of AI and computer vision. Ever since he gained his teaching position at CUHK he has been engaged in cutting-edge research that has advanced these fields. His academic work is documented in hundreds of journal articles. The titles below, a sampling from the period leading up to the formation of SenseTime, may give little insight for the non-specialist into his work but do hint at the scientific nature of his endeavors:

- "Automatic Object Segmentation From Large Scale 3D Urban Point Clouds Through Manifold Embedded Mode Seeking" (2011)
- "Learning Semi-Riemannian Metrics for Semi-Supervised Feature Extraction" (2011)
- "Symmetric Piecewise Planar Object Reconstruction from a Single Image" (2011)
- "Coupled Information-Theoretic Encoding for Face Photo-Sketch Recognition" (2011)
- "Hierarchical Face Parsing via Deep Learning" (2012)
- "Understanding Collective Crowd Behaviors: Learning a Mixture Model of Dynamic Pedestrian-Agents" (2012)
- "Image Transformation Based on Learning Dictionaries Across Image Spaces" (2013)
- "Deep Convolutional Network Cascade for Facial Point Detection" (2013)
- "Switchable Deep Network for Pedestrian Detection" (2014)
- "DeepReID: Deep Filter Pairing Neural Network for Person Re-Identification" (2014)

The fact that he is still focused on scientific research (he remains in his positions at CUHK and the Multimedia Lab) is attested by his ongoing patent history. One data base identified 76 patents by SenseTime personnel, 33 of which included Tang Xiao'ou's name. The most recent include:

- “Method and System For Facial Attribute Recognition and Pattern Generation” (2015)
- “Face Liveness Detection System and Method Based On Light Pulse” (2015)
- “A Monitoring System and Method Based On Deep Image Information” (2016)
- “Method and System For Facial Data Verification” (2017)
- “Method and Equipment For Video Classification and Recognition” (2017)
- “Training Method For Object Classification Method and Object Classification Machine” (2018)
- “Methods For Neural Network Generation and Facial Examination” (2018)
- “Time Field Movement Detection Method and System, Electronic Equipment, and Computer Memory Media” (2018)
- “Equipment and Method For Image Semantic Tagging” (2018)
- “Method and System Using Social Relationship Recognition” (2018)
- “Crucial Facial Attributes Using Orientation Of Facial Images” (2018)
- “Method and Equipment Based On Forecast Image Sample Attributes” (2019)
- “Method and System Based On Standardized Image Verification Of Facial Images” (2019)

This record suggests he sees himself as much as a scientist advancing the AI field as he is the director of a billion-dollar corporation.

Tang is an astute manager of technical talent. He drew personnel to him and into the academic world by making the Multimedia Lab a world-class research entity. Many of SenseTime's founders passed through the Lab. SenseTime CEO Xu LI worked for Motorola and the Microsoft Asia Lab but quit in 2010 and moved to Hong Kong, entering the CUHK Multimedia Lab to continue his studies under Tang Xiao'ou. Deputy Director Xu Bing was a sophomore student in Tang's computer vision class at CUHK, and later entered the Multimedia Lab's doctoral program. Wang Xiaogang got his master's degree under Tang in information engineering at CUHK, got his doctorate from MIT, then returned to Hong Kong and has been serving as the SenseTime Lab Director. Research Lab Deputy Director Lin Dahua also followed Tang from the Multimedia Lab. Many of SenseTime's middle-level employees had also been Tang Xiao'ou's students who had gone on to Facebook, Google, and Microsoft to work, then returned to SenseTime to put their efforts into developing Chinese AI.

Tang also attracted personnel from his time at Microsoft. Wang Xiaogang was also with Tang at Microsoft, and the Sensetime Director of Education Dai Juan was a student of Tang's at Microsoft. SenseTime co-founder Yang Fan was another co-worker of Tang's at

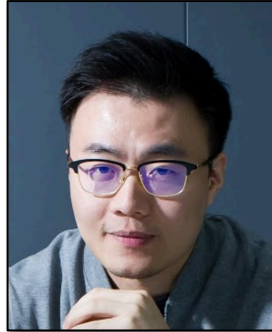
Microsoft. After joining SenseTime, Yang Fan brought in a big group of his own students from Tsinghua University.

Xu Li



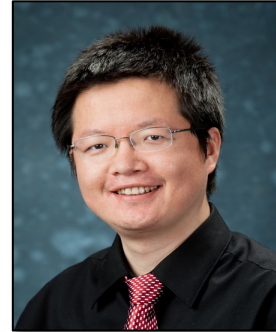
Source: sohu.com

Xu Bing



Source: cn.technode.com

Wang Xiaogang



Source: cuhk.edu.hk

Another reflection of Tang's focus on academic talent was how he has spent his money. He used the capital raised from IDG in investment round A in 2014 to hire a large number of PhD's and to buy the hardware to build a supercomputing platform. By 2016, he had gathered more than 150 top PhD's in the AI field into SenseTime.

Tang has been a successful attractor of investment capital. Sensetime's earliest investor, IDG Capital's Niu Kuining, said that when he flew to Hong Kong to see SenseTime's initial team, he saw no more than five or six computer recognition technology demos and immediately made the decision to invest. This was reportedly the only time that IDG invested in a project without seeing a finished product. When SenseTime had nearly exhausted the initial investment money, well-known Chinese actor Ren Quan brought in StarVC for the A+ round of investment, which injected several million dollars into the company. Following this, as SenseTime products became popular, Tang drew a wider range of investors into supporting the company (see table, below).

Date	Round	Raised	Investors
Nov 2014	Series A	\$2 million	IDG Capital
Nov 2015	Series A+	\$10 million	StarVC
Jul 2017	Series B	\$410 million	CDH Investments, Sailing Capital
Nov 2017	Series C	\$500 million	Qualcomm
Apr 2018	Series C	\$600 million	Alibaba Group
May 2018	Series C	\$620 million	Fidelity International, HOPU Investment Management Company, Silver Lake Partners, Tiger Global Management
Sep 2018	Series D	\$1 billion	SoftBank Vision Fund

Tang has developed and maintained strong international connections. Starting with his departure for the United States in 1990 to pursue higher education, Tang has been engaged with the world outside of China in a number of ways. Some of these have been mentioned above:

- Through SenseTime, he served as a kind of bridge between mainland China and Hong Kong academic entities. This is reflected in his founding of a joint lab connecting CUHK with the Shenzhen Advanced Research Institute.
- He established a partnership with the MIT Intelligence Quest plan and has funded several of their projects.
- He is a Fellow in the international organization IEEE and worked in the planning and execution of its annual conferences.
- He has been entrusted by the Malaysian government as Director of its National Sovereign Wealth Fund.

SenseTime work has also garnered international recognition in a number of ways. In 2015, SenseTime was the first Chinese company to be champion at the international ImageNet Computer Vision Olympics. The Multimedia Laboratory was the only representative from Asia to make it onto Nvidia's 2016 Top 10 Leading AI Labs list. SenseTime was named at the same time as one of the top ten AI labs in the world.

SenseTime is building on this international reputation to push its products out across China's borders to the international market. A recent example is a contract with a subsidiary of Korean electronics giant LG on the deployment of SenseTime facial recognition systems at points of entry at its main office in Seoul. SenseTime has also been pursuing business in Singapore, Malaysia, Japan, and the Middle East. The success of this push is indicated by reports that even by 2018, 16 percent of SenseTime revenue came from foreign countries.

Tang is known as a man with a sense of humor. Despite the fact that his primary persona is that of a serious academic, a scientific researcher, Tang Xiao'ou is known in China for being a funny guy. A typical article in Chinese media, entitled "Artificial Intelligence Has Kept Him From Being a Talk Show Host," said "Tang Xiao'ou has always been able to teach in an entertaining fashion, to make technology interesting to his audience." Other articles view him as essentially having missed his calling as a stand-up comic. He frequently salts his most serious international presentations with funny reference to movies, pictures of his son, and jokes about his personal history. In one he remarked, "I have always felt that Bill [Gates] made just two great decisions in his life: the first was signing an agreement with IBM for DOS, and the second was setting up the Microsoft Asia lab."

He has presented examples of his image management software by showing how he pasted his son's portrait into a Chinese animated cartoon, making his son the hero of the story. At a presentation at MIT, he showed a photo of his son and wanted MIT to remember him because he will need support to get him into college in the future. He said he wasn't at all sure he could get him into MIT, but maybe they could write him a recommendation for getting into Harvard.

Tang talking about his son in a presentation



Source: tech.163.com

In an unexpected turn for a serious academic, during his time at the Asia Lab he was also unanimously selected as the lab's arts ensemble director, and he served for three years running as host of the annual arts dinner.

Comments

Tang Xiao'ou is in one sense a model of the Chinese technology start-up founder that China seeks to foster. He is advancing the state of development in the AI technology sector at a time when the Chinese government sees this as key to China's emergence as a world tech leader. He is supportive of the government by developing facial recognition and smart city technology that is being used to expand the government's security systems. SenseTime has claimed that part of its data set comes from government agencies that have made the data available to help the company train its algorithms. He is recognized by the government as a technology leader, as indicated by his nomination to head the government effort to develop a next-generation AI platform for computer vision.

At the same time, Tang falls outside the Chinese start-up stereotype by having a long history in serious academic research and a life rooted in the university environment. He is 52 years old rather than some brash youngster. He is not an overnight sensation. Rather, the formation of SenseTime as a commercial entity was the culmination of 29 years of academic study and research. In addition, while Tang and SenseTime appear to have a comfortable relationship with the Chinese government, there was no evidence found that Tang has received any financial support from Beijing. He appears to have built his company entirely from well-documented private investment.

Still, his vision has a patriotic element to it. He has been quoted as saying that "in artificial intelligence, the Chinese are capable of and will truly become the lead runners

in the world. I have great confidence in this." He has highlighted that AI is a major opportunity for China, not just for SenseTime. Furthermore, he has stated that pushing technology forward is an opportunity to repay the country:

"We, in the process of growing up, have enjoyed top-quality national education resources. We ought pay back these sources through innovation, creating something of significance, proving the value of the Chinese people in the struggle of basic research. These are the feelings that China's current intellectuals should have."

Appendix: Contact Data

Professor Tang Xiao'ou

Outstanding Fellow of the Faculty of Engineering, China University of Hong Kong

Address: Room 809, Ho Sin Hang Engineering Building, CUHK

Email: xtang[[@](mailto:xtang@je.cuhk.edu.hk)]je.cuhk.edu.hk

Tel: (852) 3943-8379

Fax: (852) 2603-5032