



42 | INDEX  
ANALYST  
ACADEMY  
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**METROPOLITAN**  
**HORIZONS**

## **Out of the Box – Towards Understanding AI and Innovation with Chinese Characteristics**

**Alexander G. Welzl**

**Beijing Humboldt Forum 2019, Beijing & Chengdu, PR China  
September 22nd & 24th, 2019**

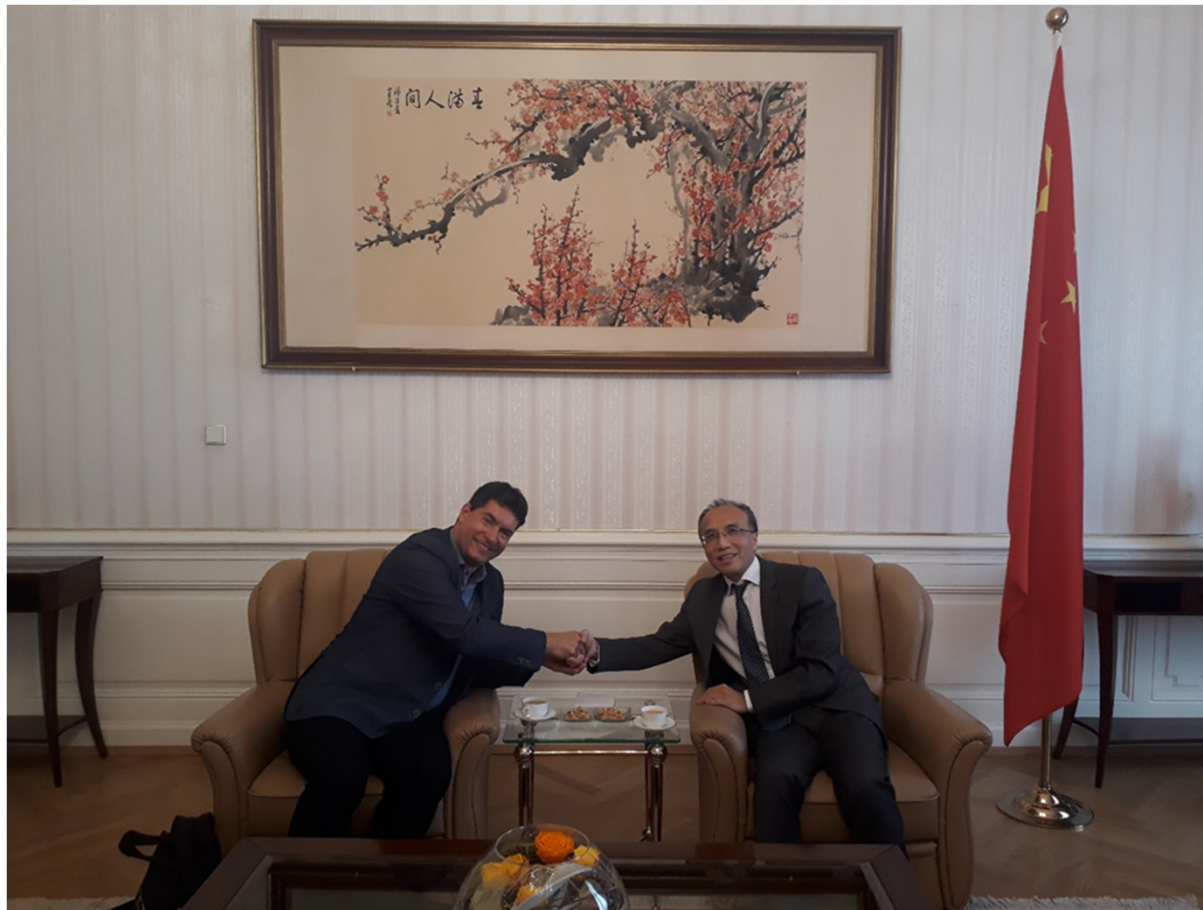


# 1<sup>st</sup> Lecture on China's NIS at a European University - started at UASTW in September 2018



- **Title „From ‚Made in China‘ to Created in China‘**
- Lecturer: Alexander G. Welzl
- Focus on National Innovation System (NIS) of PR China, corporate management of innovation and creativity in Chinese (owned) enterprises doing business in Austria and CEE, BRI, digital transformation & green economy in China
- Guest lectures from CEOs of Chinese (owned) companies, experts and scholars eg Prof. Aihua Qin CASS IES

# UASTW Lecture on China's NIS officially supported by Chinese Embassy



Bilateral meeting at  
the Chinese  
Embassy in Austria,  
Vienna 24 June  
2019,  
from right to left:  
***H.E. Ambassador Li  
Xiaosi***  
(Ambassador of the  
People's Republic of  
China to Austria),  
***Alexander G.  
WELZL***

# Collaboration with Chinese Academy of Social Sciences (CASS), Beijing: started June 2018



- Kick-off Meeting with **Prof. Huang Ping (Chinese Academy of Social Sciences, Institute of European Studies CASS IES, Beijing /PR China)**, UASTW Rector Fritz Schmöllebeck and Alexander G. Welzl at UASTW in Vienna/Austria on 4 June 2018
- start of a long-lasting cooperation of mutual interests

# Welzl guest lecture on innovation and translational research in China at Peking University, April 2019



PKU Institute of New Structural Economics: <http://www.nse.pku.edu.cn/sylm/jzyg/285834.htm>

from left to right:

**Dr. Jia YU** (Director, Department of International Development Cooperation, Institute of New Structural Economics, Peking University),

**Alexander G. WELZL**,

**Alain NADEAU** (Head of EIB Representation for China & Mongolia),

**Philippe VIALATTE** (Minister Counsellor, Head of the Science & Technology Section, Delegation of the European Union to China)

Welzl (visiting fellow Zhejiang University) guest lecture on innovation governance at NIIM in Hangzhou in April 2019



From left to right: Prof. Dong WU (NIIM and School of Management, Zhejiang University), Alexander G. WELZL, Prof. Can HUANG (NIIM and School of Management, Zhejiang University) and PhD-students  
[http://niim.zju.edu.cn/news\\_info.php?id=2007](http://niim.zju.edu.cn/news_info.php?id=2007)

# Universities of Applied Sciences in Austria I

21 Universities of Applied Sciences in Austria  
456 Study Programmes  
241 Bachelor Programmes  
215 Master Programmes



# Universities of Applied Sciences in Austria (Data-Basis: 2016/17) II

	<b>UAS</b>	<b>UNIV</b>	<b>UAS : UNIV</b>
Students 2016/17	50.009	280.989	1 : 6
Graduates 2015/16	13.715	35.786	1 : 2.5
Graduates within tolerated time: minimum duration +1 semester 2014/15	13.114	10.040	!



# Universities of Applied Sciences in Austria (Data-Basis: 2016/17) III

	<b>UAS</b>	<b>UNIV</b>	<b>Share of UAS</b>
Social Sciences, Business and Law	5.926	13.157	31%
Natural Sciences, Computer Sciences	1.456	5.197	22%
Engineering and IT	3.502	5.501	39%

# 42cx Center of Excellence for Artificial Intelligence (Vienna/Austria & London/UK)

## AI-42 INDEX™

The AI-42 INDEX™ consists of the 42 greatest public companies in the field of Artificial Intelligence.



Source: <https://42.cx/>



See our groundbreaking research at:

[https://42.cx/ai\\_research.php](https://42.cx/ai_research.php)

Equivalent to the Dow Jones Industrial Average (DJIA) stock market index 42cx has **introduced the AI-42 INDEX™ for publicly traded companies in artificial intelligence (AI) worldwide.**

**The AI-42 INDEX™ is an alpha weighted market index based on the market opportunities of the 42 greatest Artificial Intelligence public companies all over the globe.**

The index weighting is determined by our proprietary formula based on analytics and our expert rankings. The index was constructed as of January 1st 2017 and is rebalanced quarterly.

Out of our global artificial intelligence companies list (11.000+), the most influential companies are being selected by our Expert Advisory Board and Strategic Board by assessing the disruptive and strategic potential, the underlying AI technology, perceived risk and expected returns on the basis of a weighting of several characteristics of the companies.

# Innovation Performance of Peoples Republic of China

# China's and Asia's Industrial Transformation - Towards a Innovation-driven Development



Source: <http://english.boaoforum.org/en/index.html>

## **Premier Li Keqiang's keynote speech at Boao Forum for Asia 2019**

**Boao, Hainan Province, March 28, 2019  
– a quote of his speech (source China Daily,  
March 30-31, 2019):**

*„After years of fairly fast growth, Asian countries now face the challenge of shifting from old drivers of growth to new ones, and we must rely on innovation to foster the latter. (...) we (...) must tap into our advantages in human capital (...) to intensify cooperation on innovation. (...) We need to (...) clear the way for the unimpeded flow of factors of innovation resources and outcome, setting the stage for the steady progress of Asia's innovation-driven development.“*

# From Capitalism to Talentism - World Economic Forum 2012



**Prof. Klaus Schwab**

Source: Wikipedia

At the opening press conference of the World Economic Forum (WEF) claimed a shift from capitalism to talentism with human capital and innovation power becoming countries', cities' and companies' major competitive asset:

***“Capital is being superseded by **creativity and the ability to innovate** — and therefore by human talents — as the most important factors of production.”***

# China's Innovation Performance

## - A Legacy of Millennia of Development



*Black pottery*  
Hemudu culture  
(5000 – 3000 BC)  
Source: Wikipedia



*Painted pottery*  
Western Han  
dynasty (202 BC –  
9 AD)  
Source: Wikipedia

- **A history of Innovation taking place in China (provincial region Zhejiang):** *'Half of the history of Chinese ceramics took place in Zhejiang'* (Chen Wenli). Exhibition at Zhejiang Provincial Museum at Westlake.
- The **first pottery** was made during the **Palaeolithic era**. Pottery dating from **20,000 years ago** was found at the **Xianrendong Cave** site in **Jiangxi province**, making it among the earliest pottery yet found.
- Porcelain was a Chinese invention and is so identified with China that it is still called "china" in everyday English usage. On some Chinese definitions, the **first porcelain was made in Zhejiang province** during the **Han dynasty (206 BC – 220 AD)**.

# Part of the ‚Chinese Dream‘ - The Dawn of the Quantum Era



Source: australasianscience.com.au

It was on **Monday, 16 August 2016** when a new era was ushered in:

**at 1:40 local China time Quantum satellite MICIUS was launched** from “the launch pad 603 located at LC43 complex at the Jiuquan space centre in Jiuquan, north-west China.”

“The scientist who first proposed the idea to the European Space Agency (ESA) in 2001 is University of Vienna physicist Anton Zeilinger.”

Prof. Anton Zeilinger today is the President of the Austrian Academy of Sciences and closely works together with CAS in Beijing.

Source: <https://www.bbc.com/news/world-asia-china-37091833>

# Geopolitics of Knowledge - a 'Long-run' Game and the Big Picture

Article in 'The Diplomat', February 2018:

**“China’s bet on knowledge is already paying off; but this game, which requires lots of strategic thinking and stamina, is to be played in the long run.**

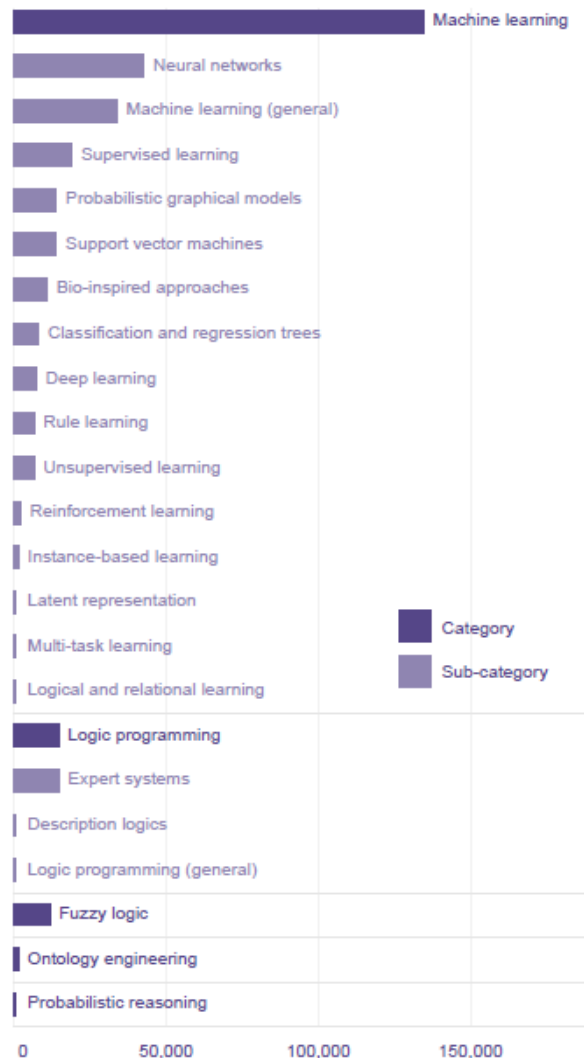
(...) China’s approach to knowledge is already bearing fruit in terms of making foreign policy. A collection of topics as cognitively sophisticated and even futuristic as the exploration and use of outer space, (...) information technology and connectivity, (...) quantum physics (...) and so on, have become the bread and butter of Chinese career diplomats, thus catering to the country’s most urgent present and future needs.”

Source: The Diplomat, February 27, 2018



# Artificial Intelligence (AI) Performance of PR China, Chinese Corporations and Research Organisations

# State-of-the-Art of AI techniques worldwide



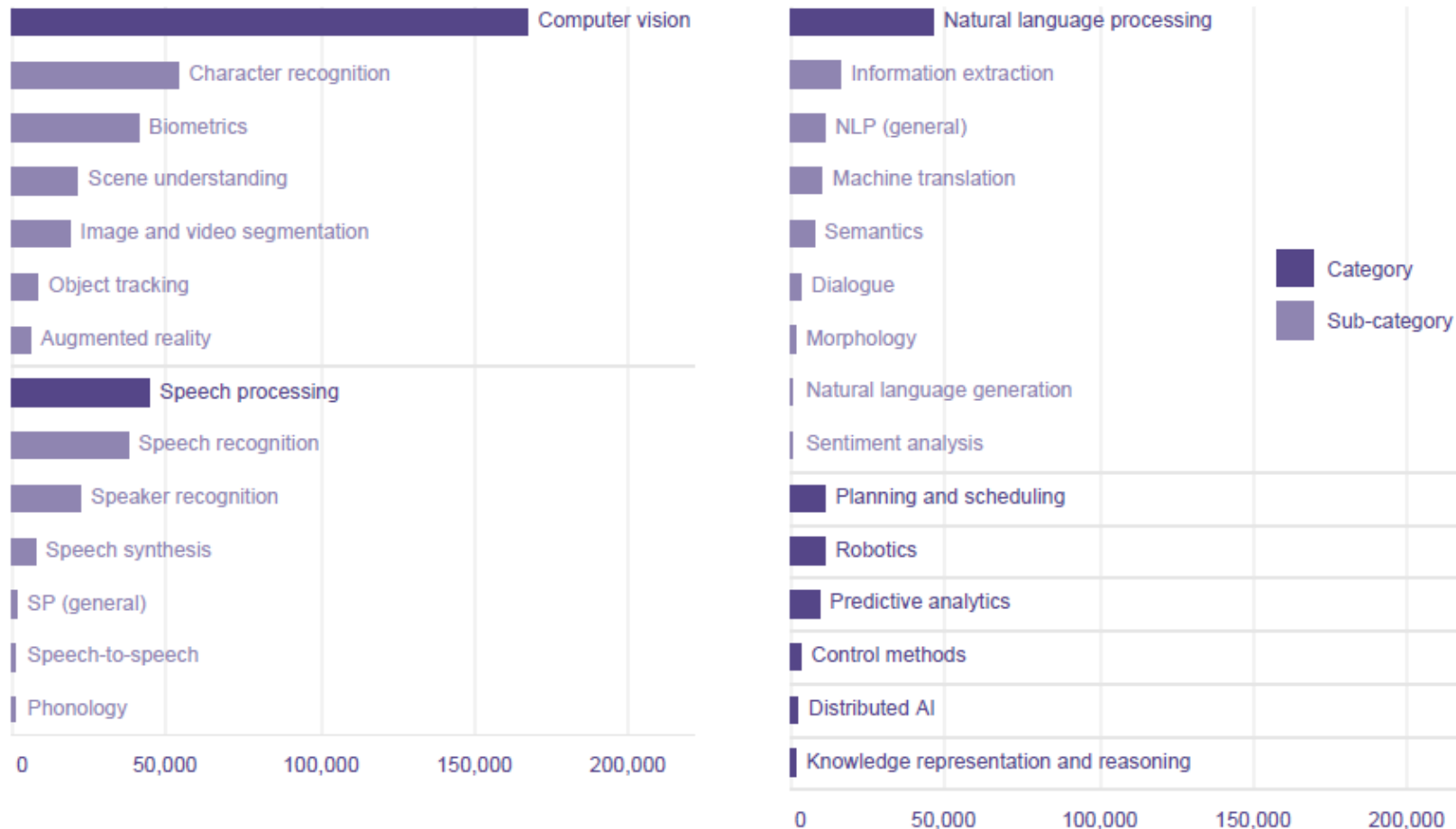
Patent families for AI technique categories and sub-categories:

Machine learning is the dominant AI technique, representing 89 percent of patent families related to an AI technique

Source: WIPO Technology Trends 2019 – Artificial Intelligence  
[https://www.wipo.int/edocs/pubdocs/en/wipo\\_pub\\_1055.pdf](https://www.wipo.int/edocs/pubdocs/en/wipo_pub_1055.pdf)

# Functional Applications of AI (2019)

## Computer vision dominates by far

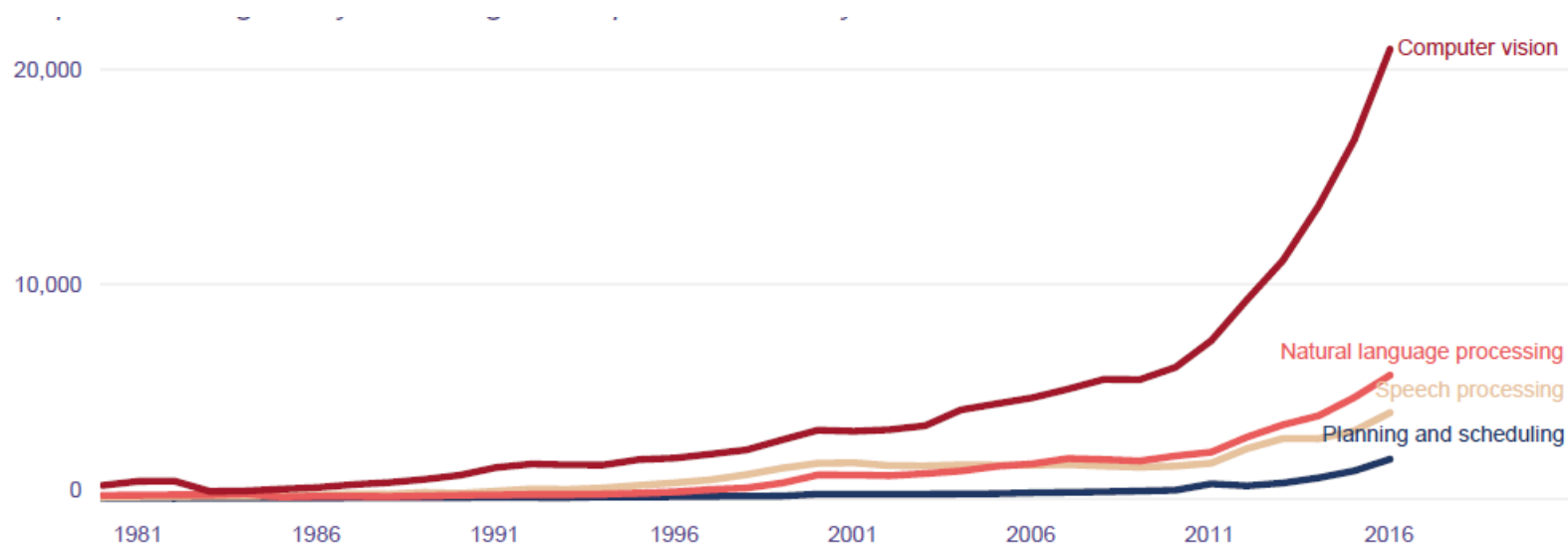


Note: A patent may refer to more than one category or sub-category

Source: WIPO Technology Trends 2019 – Artificial Intelligence

# Functional Applications of AI (1981 - 2016)

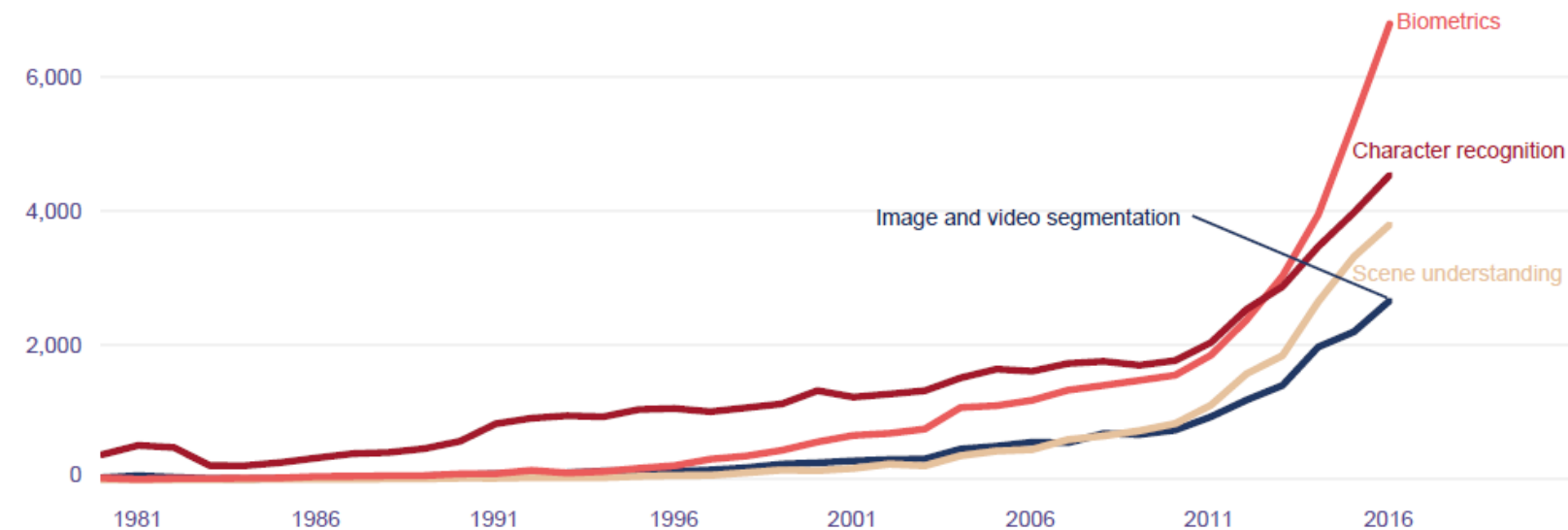
## The rise of computer vision over time



Note: A patent may refer to more than one category

Source: WIPO Technology Trends 2019 – Artificial Intelligence

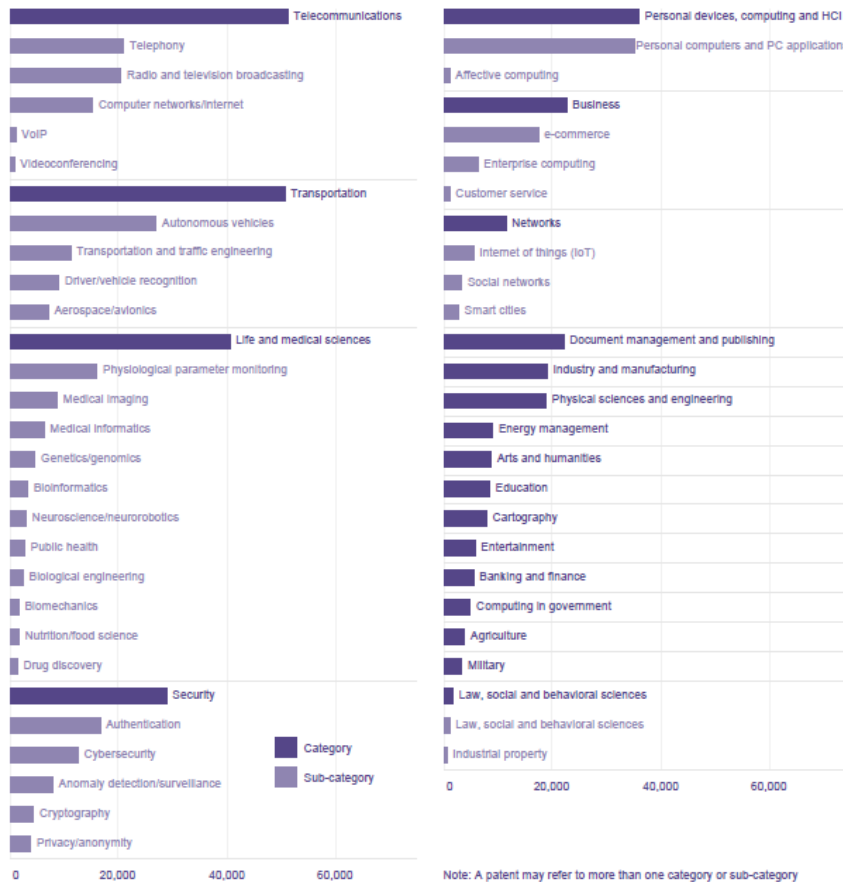
Biometrics: growth by average of 30% since 2013 surpassing all other sub-categories of computer vision



Note: A patent may refer to more than one sub-category

Source: WIPO Technology Trends 2019 – Artificial Intelligence

# AI industrial applications (2019)



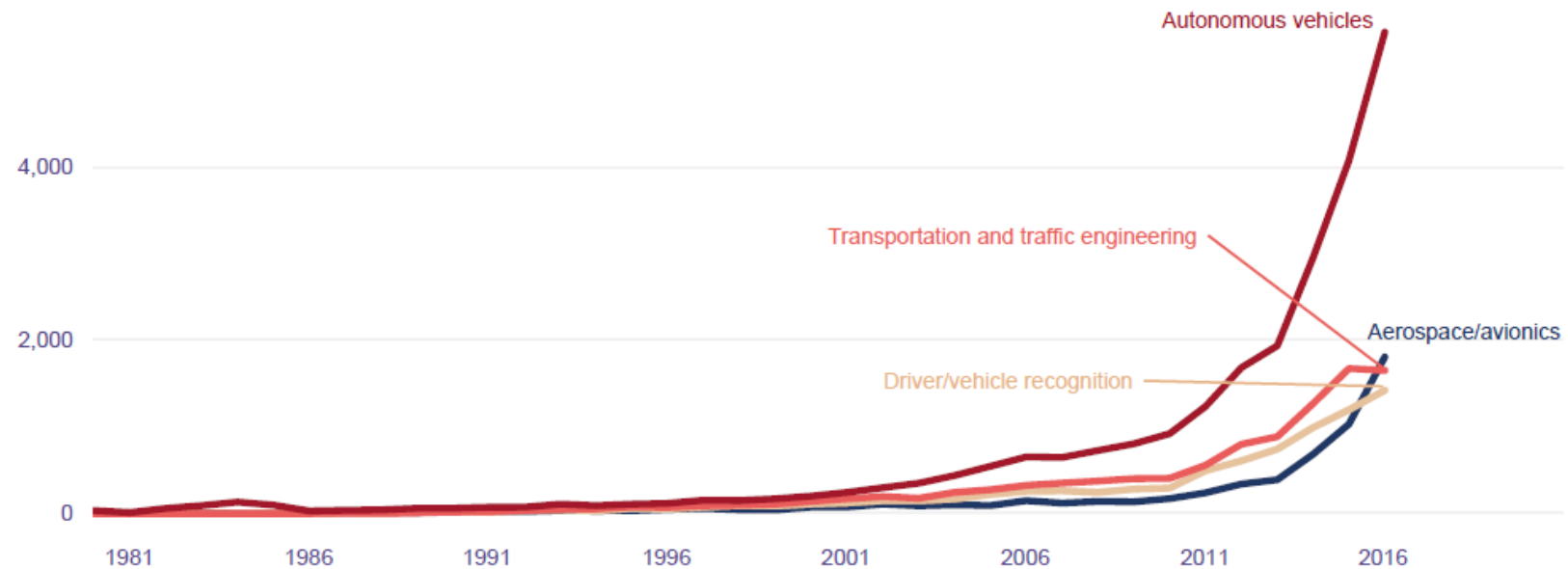
**Top four application fields mentioned in patent documents:**

- **telecommunications,**
- **transportation,**
- **life and medical sciences,**
- **personal devices, computing and HCI**

They represent 24, 24, 19 and 17 percent of all patent families related to AI application fields, respectively

Source: WIPO Technology Trends 2019 – Artificial Intelligence

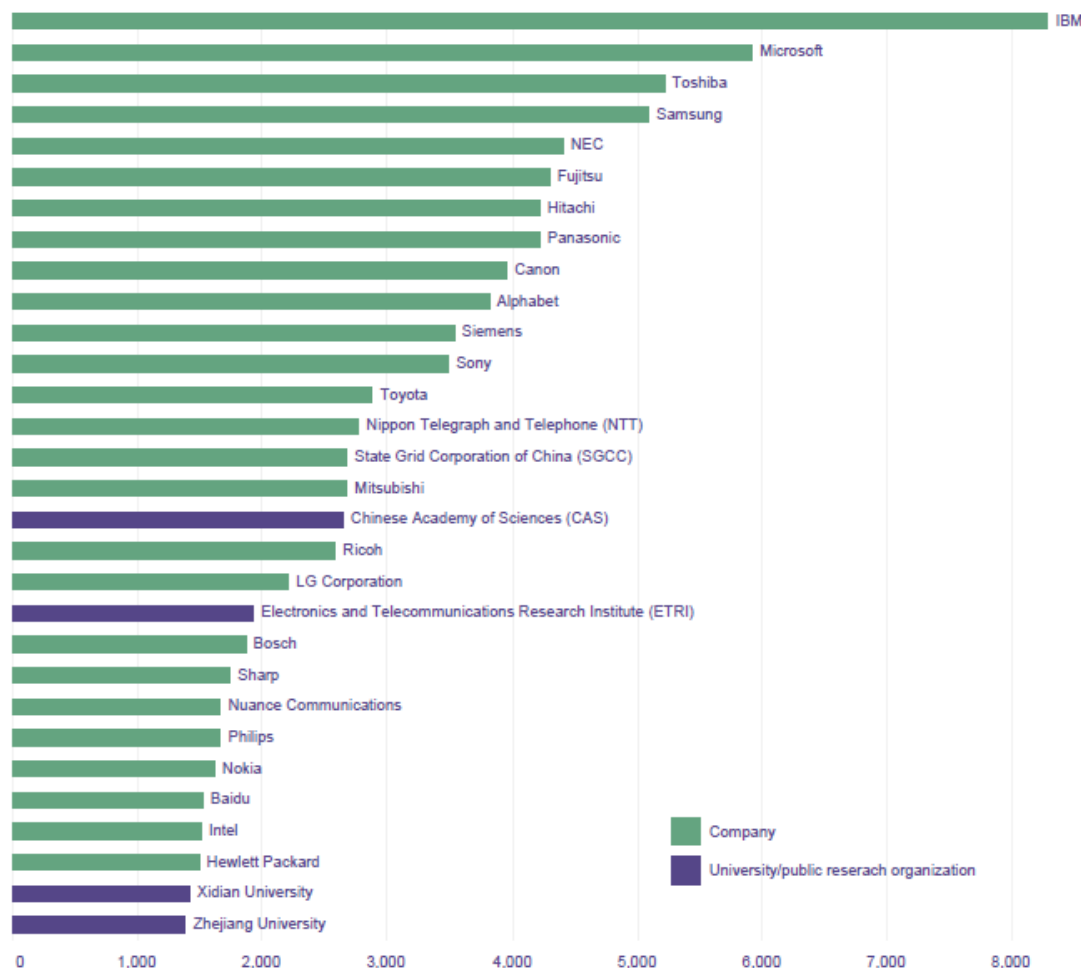
AI in transportation, *annual average growth (2013 – 2016): autonomous vehicles 42%, aerospace 67%*



Note: A patent may refer to more than one sub-category

Source: WIPO Technology Trends 2019 – Artificial Intelligence

# Global Top 30 patent applicants by number of patent families (2019)



Source: WIPO Technology Trends 2019 – Artificial Intelligence

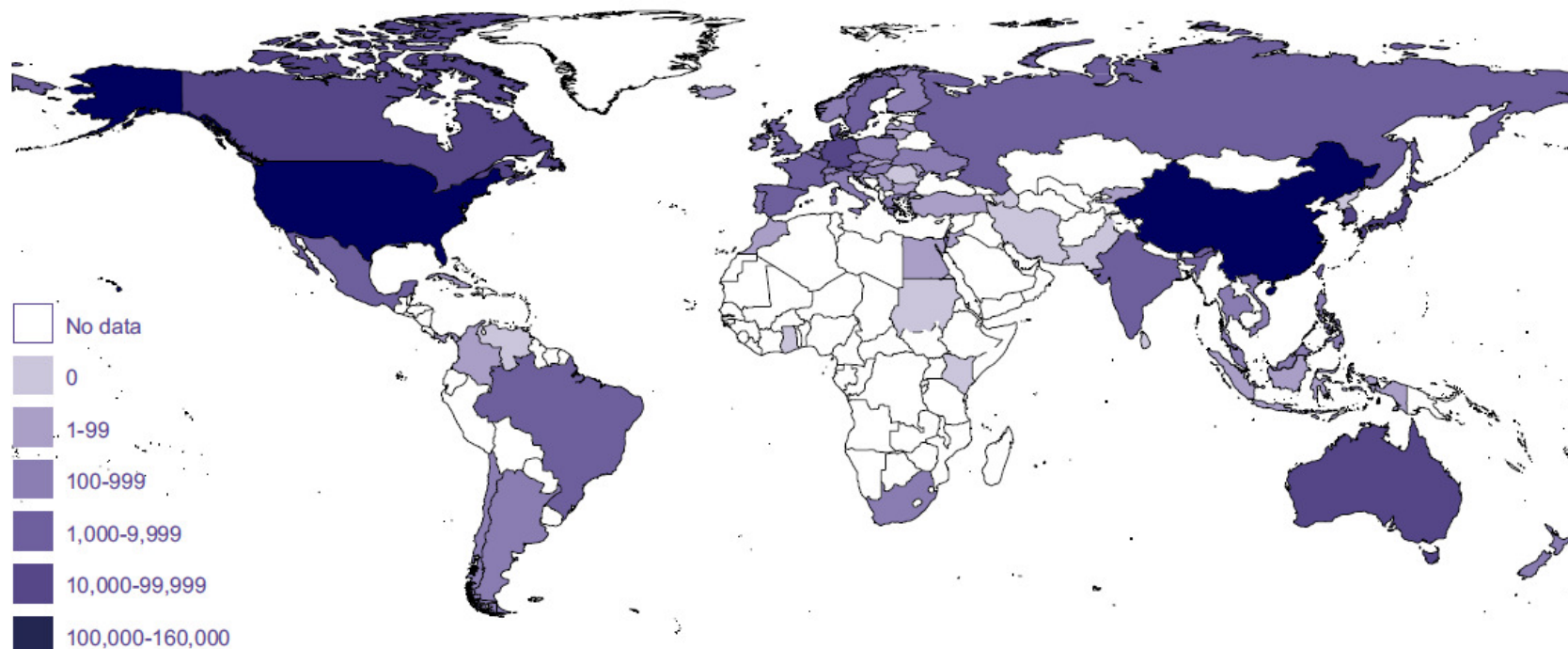
Companies represent 26 of the top 30 AI patent applicants worldwide

China well represented:  
**State Grid Corporation of China (SGCC)**  
**Baidu**  
**Chinese Academy of Sciences (CAS)**  
**Xidian University**  
**Zhejiang University**

Source: WIPO Technology Trends 2019 – Artificial Intelligence

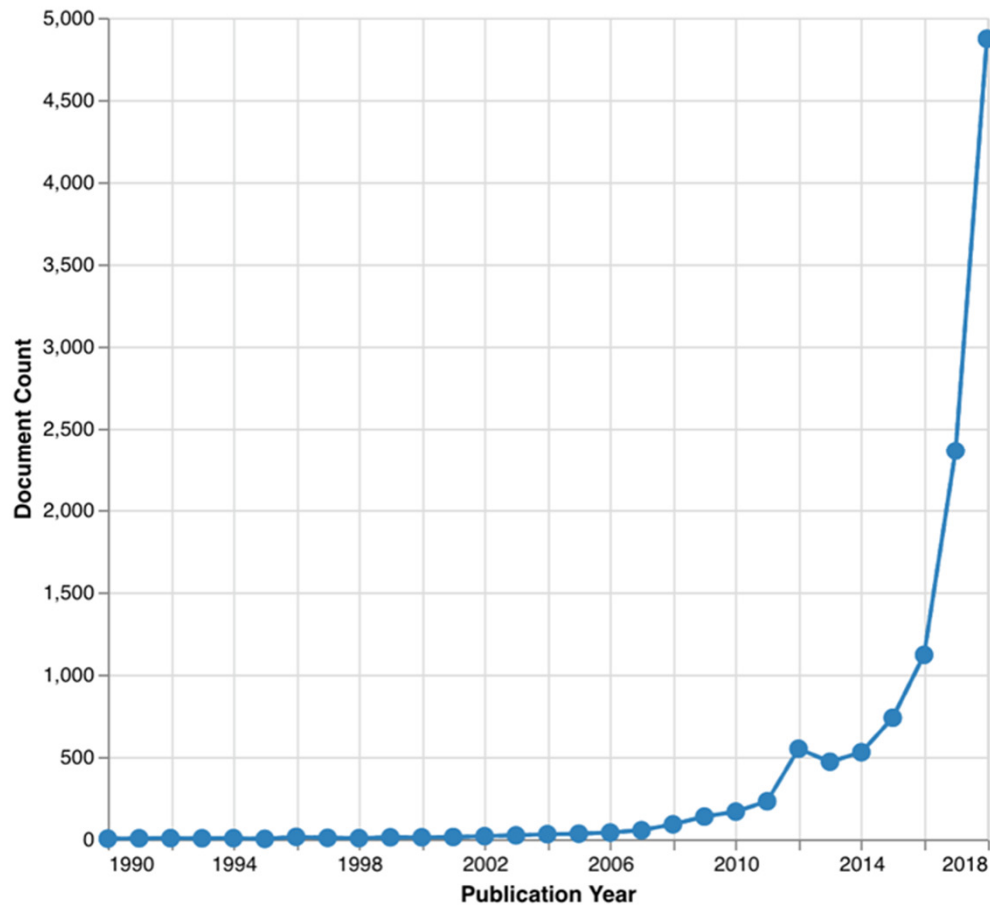


# Global distribution of AI patent applications by patent office (2019)



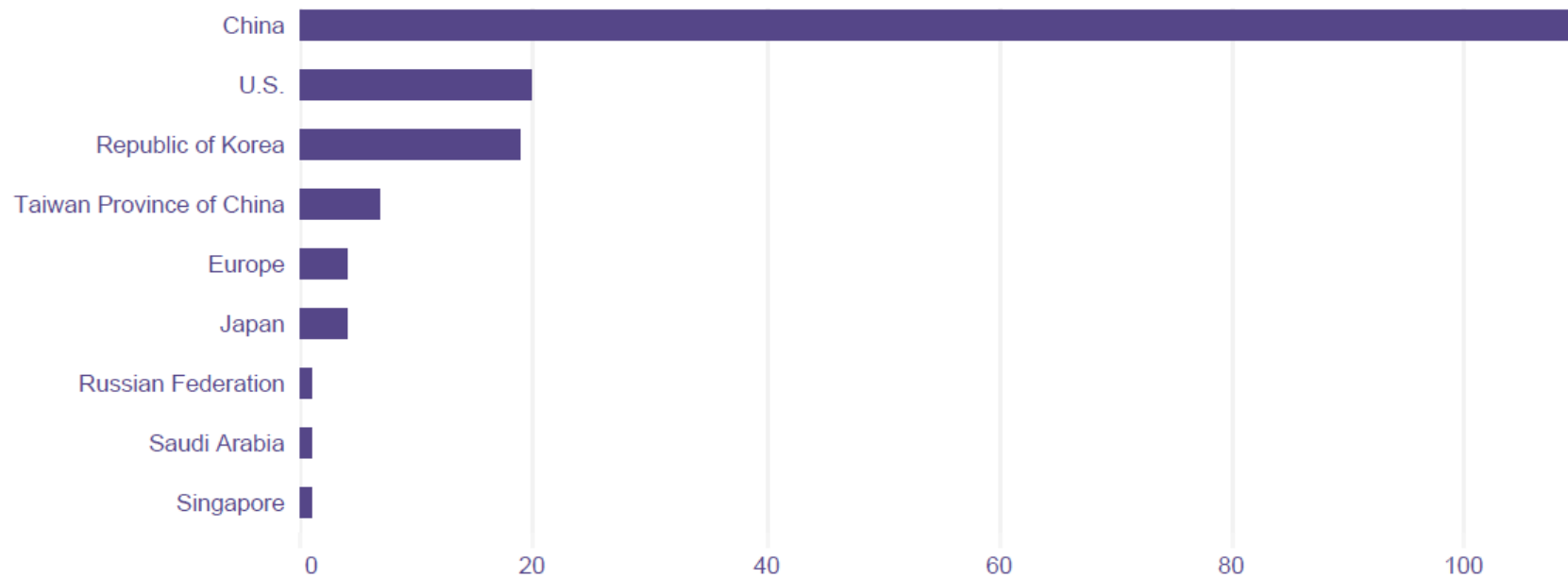
Source: WIPO Technology Trends 2019 – Artificial Intelligence

# AI patent applications in China (1990 - 2018)



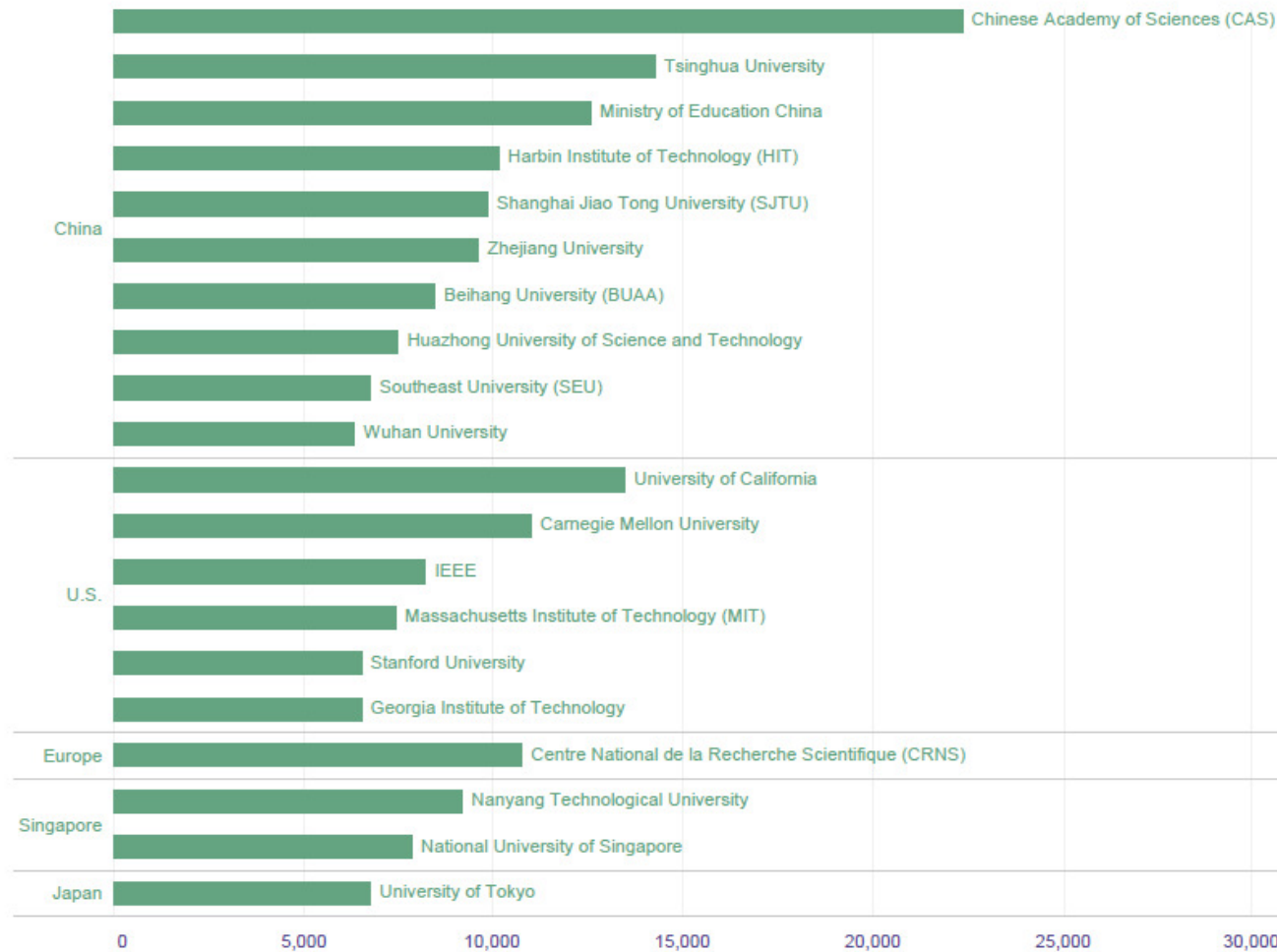
Source: 42cx (2019)

# Universities & public research organizations AI patent applicants: +20% of top 500 from China



Source: WIPO Technology Trends 2019 – Artificial Intelligence

# 10 of the top 20 organizations in AI scientific publications are in China



Source: WIPO Technology Trends 2019 – Artificial Intelligence

# The case of Baidu: a Chinese AI champion

- **In 2010** Baidu started its layout of AI, pouring R&D efforts into natural language processing, speech processing, machine learning, computer vision, deep learning, knowledge graph, and other areas.
- **In 2013**, Baidu announced the **world's first in-house institute** focusing on the study of **deep learning**.
- **In March 2017**, Baidu set up a new business group, the **Artificial Intelligence Group**, to bring AI-related departments together, aiming to better develop AI technologies and promote AI applications.
- **2019**: Baidu is now among the top AI players in the world, with more than **10,000 R&D engineers**. Its **annual R&D investment** is about **US\$2 billion**, and AI R&D accounts for a large proportion of that.

# AI on stage: Sophia the humanoid robot at UNIDO in Vienna, September 2019



Source: 42cx, Alexander G. Welzl (2019) [https://42.cx/news\\_42cx\\_read\\_my\\_lips.php](https://42.cx/news_42cx_read_my_lips.php)

Developed by Hong Kong based corporation Hanson Robotics her creators claim that Sophia's 'AI combines cutting-edge work in symbolic AI, neural networks, expert systems, machine perception, conversational natural language processing, adaptive motor control and cognitive architecture among others'.

In 2017 Sophia became the world's first robot granted a citizenship by a sovereign country. Her home country is Saudi Arabia.

# Q & A

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Thank you for your attention!

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