



Measuring **Coronavirus** Impact in China from the Sky

Measuring **Coronavirus** Impact in China from the Sky

As the WHO declares the coronavirus a pandemic, the whole world is scrambling to cope with the social, political and economic mess, while China has stabilized over the past few weeks. The true color of China's battle with the coronavirus is yet to be seen. Official data from China's National Bureau of Statistics has put the Purchasing Managers' Index (PMI) at 35.7 in February, a significant drop from 50.0 in January, and the lowest level recorded since the 2008 global financial crisis. The economic pain continues to pinch the country as people's movements remain curbed and production lines struggle to get back on track.

In this report, MioTech uses satellite imagery to find proxy variables of economic activities in China. By inspecting land surface temperature and nitrogen dioxide emissions, we bring you the true color of the coronavirus'impact on economic activities in China.

Highlights:

- Land Surface Temperature and NO2 emission data suggests China's economy was largely put to a halt in February. Only as little as 27.6% of the normal economic activities were in place in the Greater Bay Area.
- In early March, based on an analysis of the Greater Bay Area, 85.6% of the economic activities in the region have resumed.

Taking A Temperature of China's Economy

With any urban landscape, you would find office buildings, factories and other facilities consuming energy and remitting heat into the environment. Remote sensing instruments today are able to provide data over large areas to derive useful statistics to detect urban changes and thermal patterns on the ground. By applying advanced AI algorithms on historical Thermal Infrared data, MioTech finds hidden patterns of heat consumption and detect abnormalities pre and post the epidemic unrest.

We utilized Landsat 8 and Terra Thermal Infrared Sensors to detect heat patterns in the Greater Bay Area, the major tech and manufacturing hub of China. Machine learning algorithms were adopted to eliminate noise from seasonality, meteorological conditions, and geological surfaces. We also used SWIR (Short-Wave Infrared) sensors to screen out unrelated surfaces by identifying materials. The cleansed dataset (including coordinates and

heat level) is then run through a neural network based classifier to identify places that have significant economic activities in the Greater Bay Area. We use 8-day pixel by pixel thermal averages of three time frames in 2020, January 1 to January 8, February 18 to February 25, February 26 to March 4, to represent pre, during, and post-shock effects respectively.

Pre-coronavirus outbreak, as shown in *Image 1*, an average of **17.4%** of the total land area in the Greater Bay Area releases heat in patterns that show economic activities (highlighted in red).

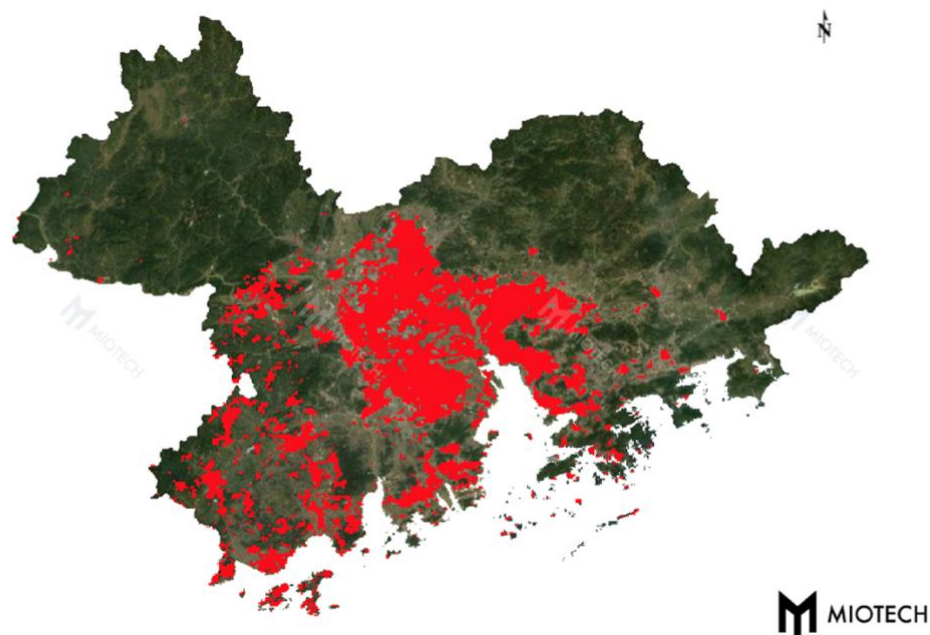


Image 1: Areas shown Economic Activities in GBA from Jan 1 to Jan 8

When quarantine measures first started to be removed, illustrated in *Image 2* from 18th to 25th of February, only an average of **4.8%** of the Greater Bay Area showed the heat patterns that indicate economic activities. This constitutes only **27.6%** of the pre-shock normal size (4.8% divided by 17.4%).

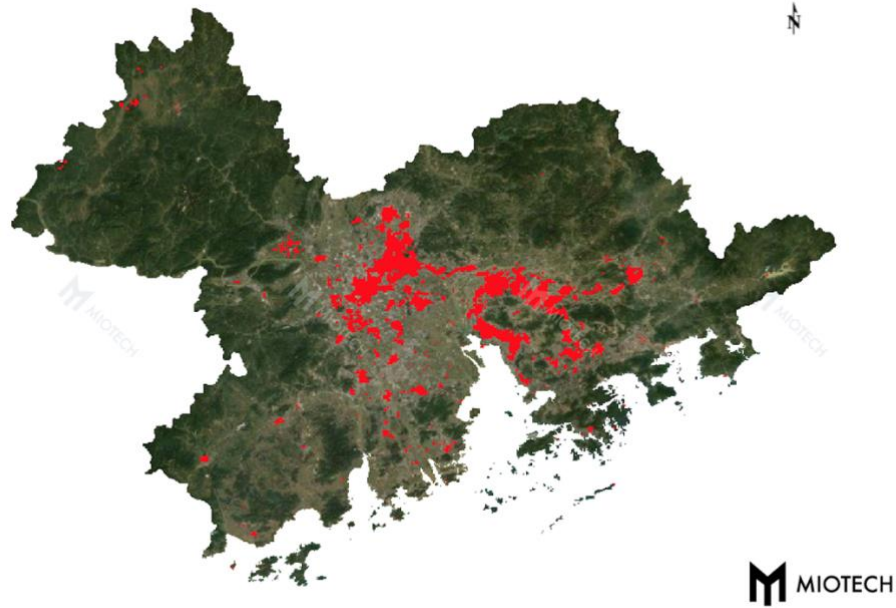


Image 2: Areas shown Economic Activities in GBA from Feb 18 to Feb 25

In *Image 3* from February 26 to March 4, economic activities have largely resumed - an average of **14.9%** of the Greater Bay Area has been consuming and releasing energy similar to the economic activities we detected before. Compared to the pre-virus number of **17.4%**, this proxy measure indicates that work resumption rate was at **85.6%** (14.9% divided by 17.4%).

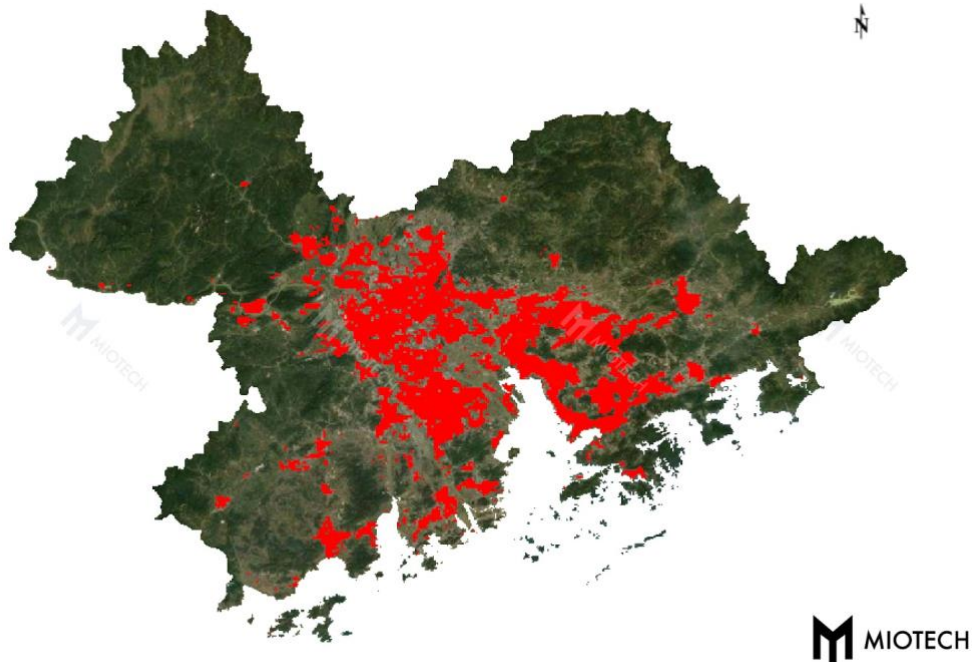


Image 3: Areas shown Economic Activities in GBA from Feb 26 to Mar 4

A Virus That Brings A Breeze of Fresh Air

Nitrogen Oxides are proxy indicators of economic activities as they are emitted from the burning of fuel. Vehicle exhaust, and the burning of coal, oil, diesel fuel, and natural gas, especially from electric power plants, are the largest sources. By tracking Nitrogen Dioxide density, MioTech can form a good understanding of not only the pollution but also energy consumption, all indicators on the health of the Chinese economy.

We used Sentinel-5P to identify the Nitrogen Dioxide density in the troposphere. The data and analyses are based on 20-day averages of two time frames in 2020, January 1 to January 20, and February 1 to February 20.

In the Greater Bay Area, before the outbreak from January 1 to January 20, **9.21%** of the area was covered by dense NO₂ (defined by density above 200 $\mu\text{mol}/\text{m}^2$). From Feb 1 - Feb 20, the size of areas covered by dense NO₂ drastically reduced to zero.

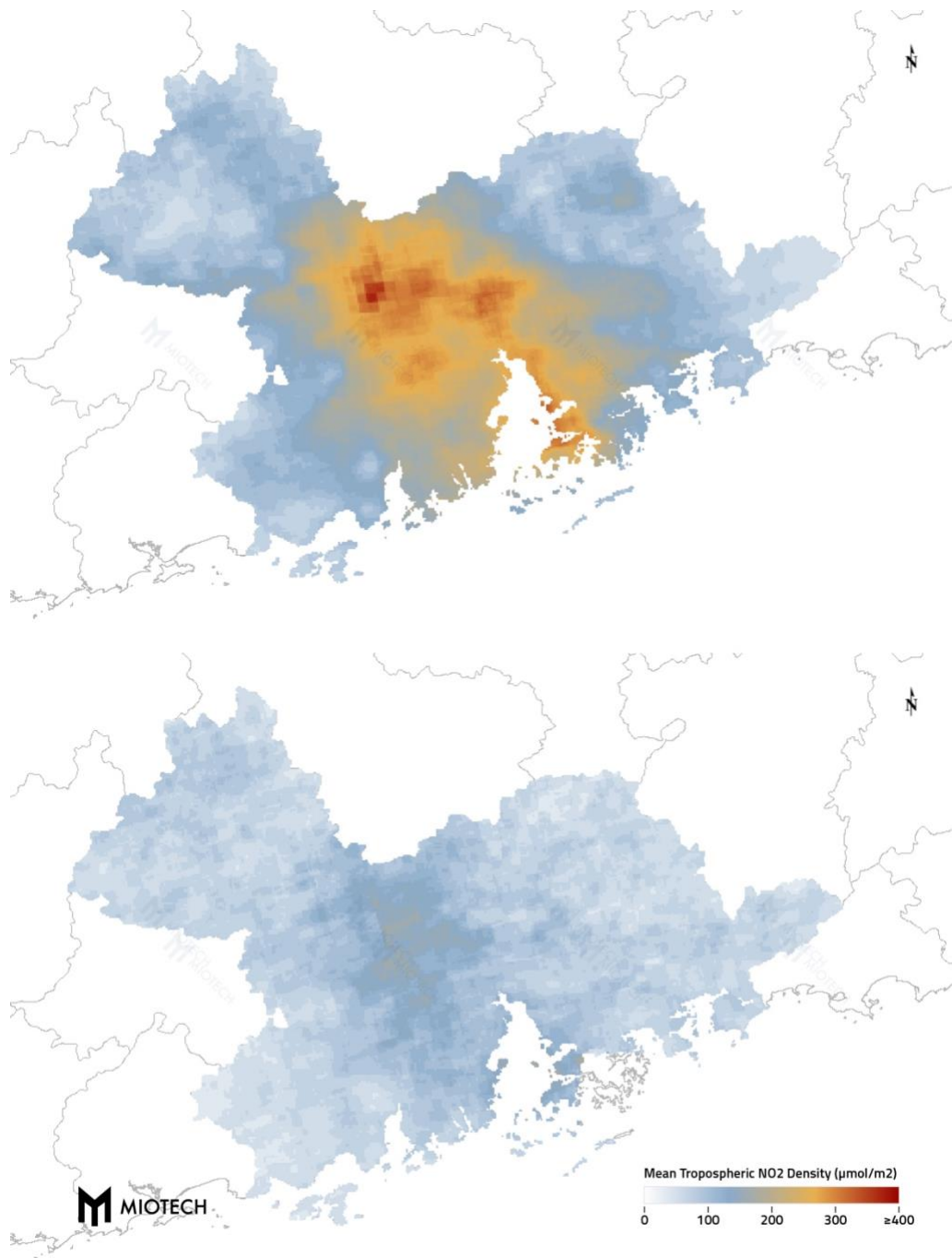


Image 4: NO₂ density in the GBA from Jan 1 to Jan 20 and from Feb 1 to Feb 20

In the other manufacturing and business hub, the Yangtze River Delta, we find the similar contrast. From January 1 to January 20, an average of **10.12%** of the area was covered by dense NO₂. From February 1 to February 20, the size of the pollutant coverage decreased to a negligible **0.0097%**.

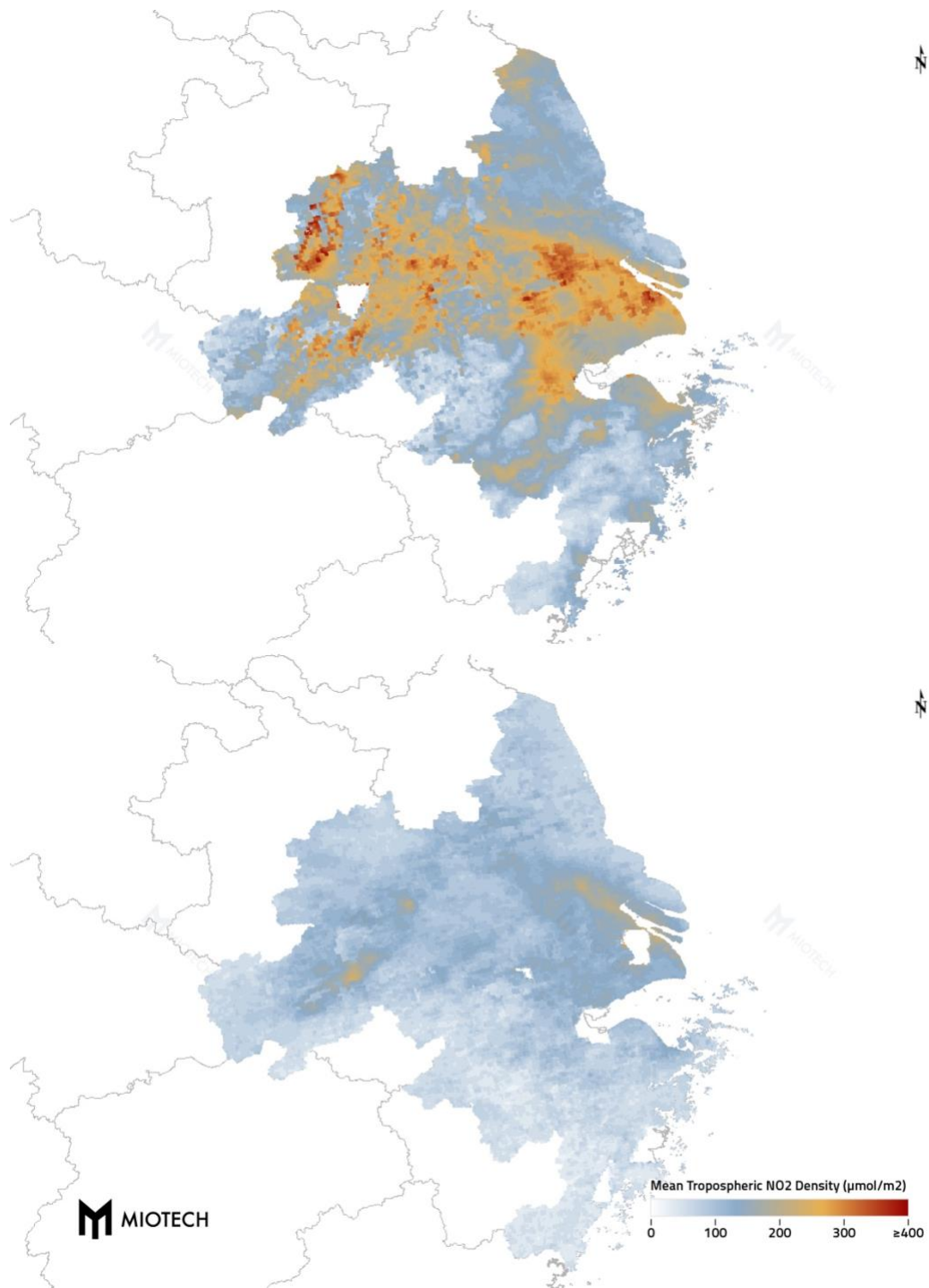


Image 5: NO₂ density in the Yangtze River Delta from Jan 1 to Jan 20 and from Feb 1 to Feb 20

It wasn't a coincidence only in the large manufacturing regions. The whole China was enjoying a breeze of fresh air in February while cities were locked down. In January, **4.56%** of China was covered by dense NO₂. In stark contrast, more than **99.9%** of China had the cleanest air - only **0.078%** of China was covered dense NO₂.

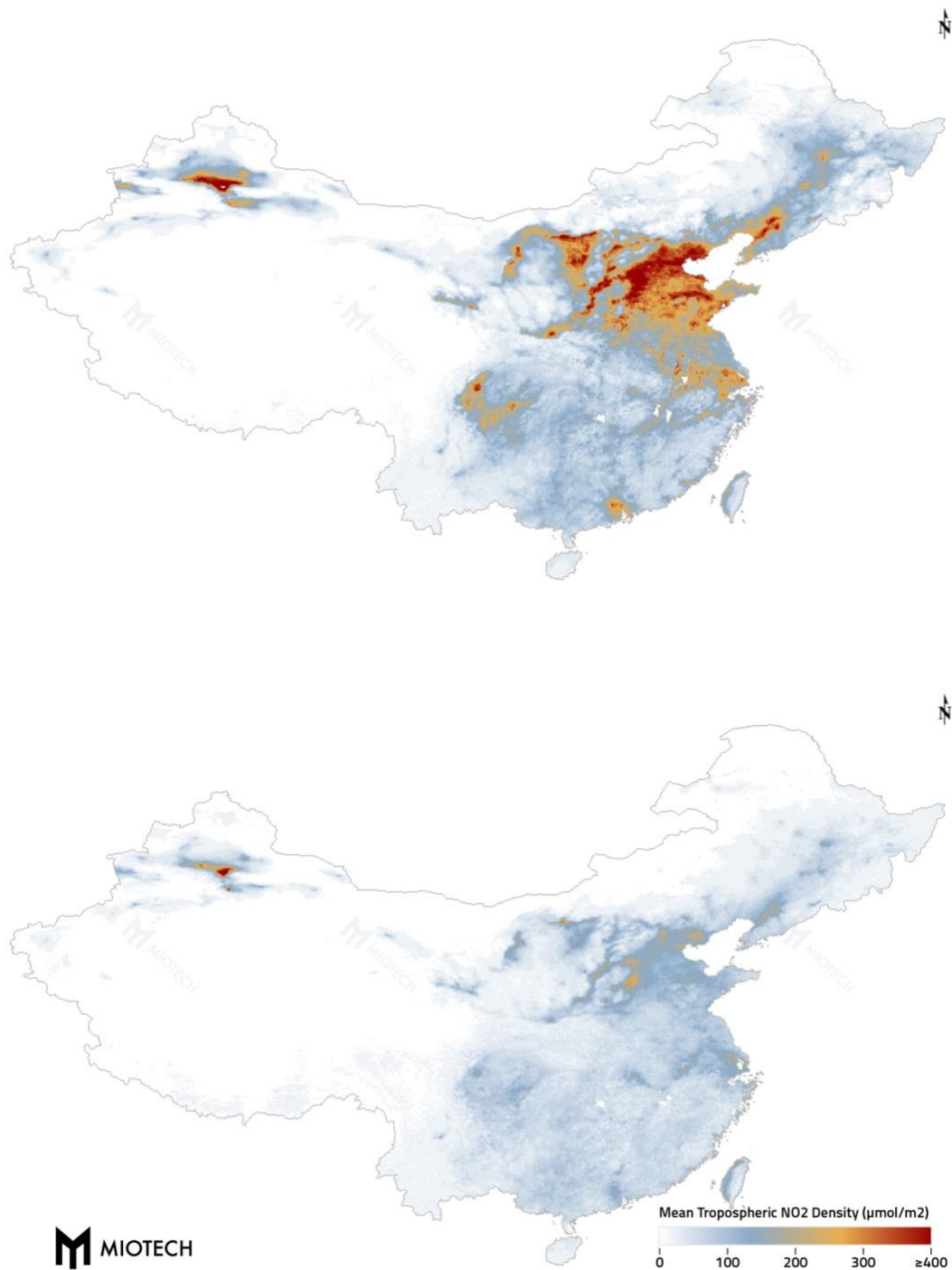


Image 6: NO₂ density in China from Jan 1 to Jan 20 and from Feb 1 to Feb 20

Amid signs of recovery, the coronavirus' chilling effects continue to spread over the whole globe. Evidence from remote sensing shows the economic pain caused by the draconian measures imposed in China. As China gradually goes back to work, the speed of recovery will have implications to other parts of the world as well.

Authors



Jason Tu

Co-founder & CEO, MioTech
jt@miotech.com



Gingery Jin

Product Manager, MioTech
gingeryjin@miotech.com



Maya Li

Senior Corporate Communications Manager, MioTech
maya.li@miotech.com

General Disclaimer

This document and all the information contained in it, including without limitation all text, data, graphs, charts (collectively, the "Information") is the property of Mioying Financial Technology (HK) Limited (MioTech) and is provided for informational purposes only.

Contact Info

+852 29522892

info@miotech.com

1801-02, FWD Financial Centre, 308 Des Voeux Road Central, Hong Kong