Datasheet

（SWIR）Hypespectral Camera	ATH1010R

Features

- Imaging mode： Transmission grating，high sensitivity
- Max.spectral range: 0.9~1.7 μm or 1.0~2.5 μm
- Max.spatial channels: 640 or 1280
- Max.spectral channels: 512 or 1024
- FOV: 15.2°（Lens changeable）
- Outstanding imaging performance
- Data format compatible with ENVI
- Compact size: 370mm x 85mm x 95mm
- Lightweight: 1780g

Application

- Geological and mineral resources exploration
- Precision agriculture, crop growth and yield assessment
- Forest pest and disease monitoring, fire prevention monitoring
- Coastal and marine environment monitoring
- Grassland productivity and monitoring
- Lake and watershed environmental monitoring
- Remote sensing education and research
- Industrial sorting
- Ecological environment protection and mining environment monitoring
- Water quality testing, soil monitoring

Description

ATH1010R Shortwave Infrared Hyperspectral Imager is a compact, lightweight system optimized for UAV integration. Operating in 0.9-1.7 μm or 1.0-2.5 μm spectral ranges, it combines high spatial/spectral resolution and wide imaging coverage.

The system features a 1280×1024 or 640×512 pixel detector array using deep-cooled InGaAs or HgCdTe technology, ensuring low-noise imaging with excellent linearity. Its thermally stabilized optical system delivers exceptional stability and sensitivity for demanding applications in pharmaceutical QA, food safety inspection, and agricultural analytics, suitable for laboratory, field, and industrial environments.

Comprising two core modules - imaging optics and hyperspectral imager - the device maintains robust performance across varied operating conditions.

Model	Wavelength Range
ATH1010R-17	0.9~1.7 μm, 640*512
ATH1010R-17H	0.9~ 1.7 μm, 1280*1024
ATH1010R-25	1.0~2.5 μm, 640*512

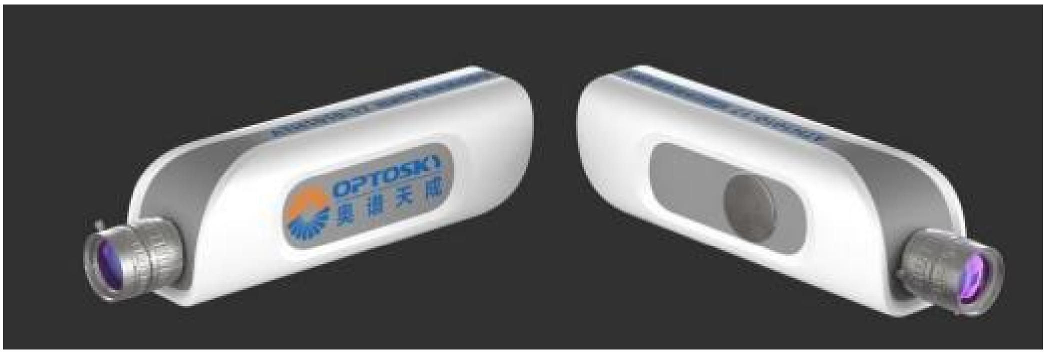

Fig. 1 ATH1010R-17 (Wavelength 0.9-1.7μm)

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Fig. 2 ATH1010R-25 (Wavelength 1.0-2.5μm)

1. Selection Guide

Model	Descripe
ATH1010	400-1000 nm VIS-NIR Hyperspectral Camera
ATH1010R-17	0.9~ 1.7μm SWIR, 640*512
ATH1010R-17H	0.9~ 1.7μm SWIR, 1280*1024
ATH1010R-25	1.0~2.5μm SWIR, 640*512
ATH1010W-4-17	0.4~ 1.7 μm Broadband Hypespectral Camera
ATH1010W-4-25	0.4~2.5μm Broadband SWIR Hypespectral Camera

2. Parameters

NO.	Specifications	ATH1010R-17	ATH1010R-25	ATH1010R-17HS	ATH1010R-17H
1	Spectral Range	0.9~ 1.7 μm	1.0~2.5 μm	0.9~ 1.7 μm	0.9~ 1.7 μm
2	Detector	InGaAs Detector	Deep-cooled MCT Detecto	InGaAs Detector	InGaAs Detector
3	Number of Spectral Channels	640	640	640	1280
4	Number of Spatial Channels	512	512	512	1024
5	Spectral	5.5nm	8.5nm	5.5nm	2nm

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	Resolution				
6	Native Resolution of the Detector	640 X 512	640 X 512	640 X 512	1280 X 1024
7	Native Pixel Size of the Detector	15 μm x 15 μm			5 μm x 5 μm
8	Detector Interface	USB3.0			
9	Pixel Bit Depth	14 bits			12 bits
10	Detector Target Size	9.6 X 7.68 mm			6.4 X 5.12 mm
11	Average Noise (NETD)	/	<50 mK	/	/
12	Field of View	21.04°@f=35mm			8.3°@f=35mm
13	Instantaneous Field of View	0.18mrad@f=35mm			0.15mrad@f=35 mm
14	Maximum Frame Rate	80fps	60 fps	700 fps	118 fps
15	Dimensions	265mm x98mm x 85mm	370mm x 110mm x 95mm	265mm x98mm x 85mm	265mm x98mm x 85mm
16	Weight	800g	2700g	800g	800g
17	Operating Temperature	-20 - 50°C	-20 - 50°C	-20 - 50°C	-20 - 50°C
18	Storage Temperature	-30-70°C	-30-70°C	-30-70°C	-30-70°C

3. Imaging Test

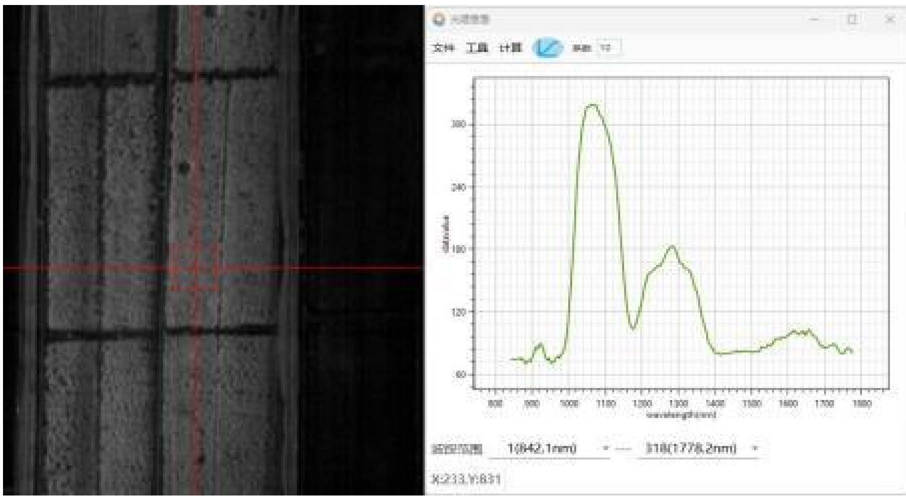

Fig. 3.1 Rice imaging results 1

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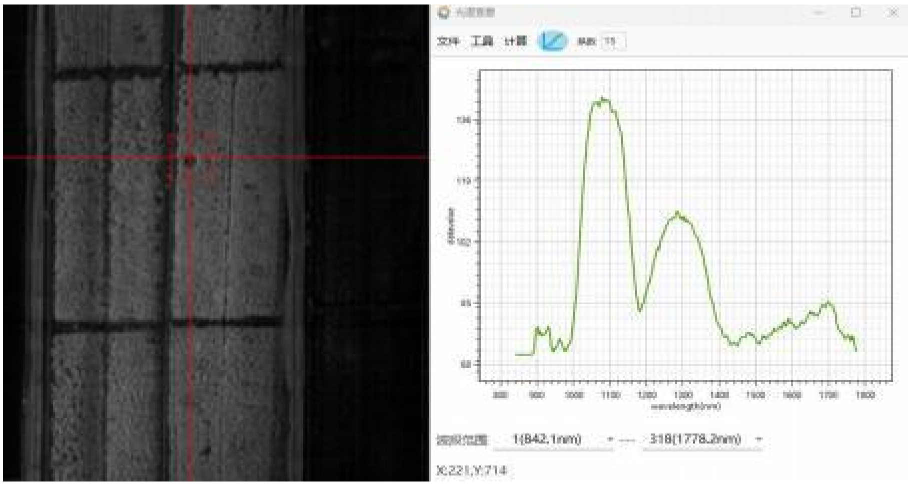

Fig. 3.2 Rice imaging results 2

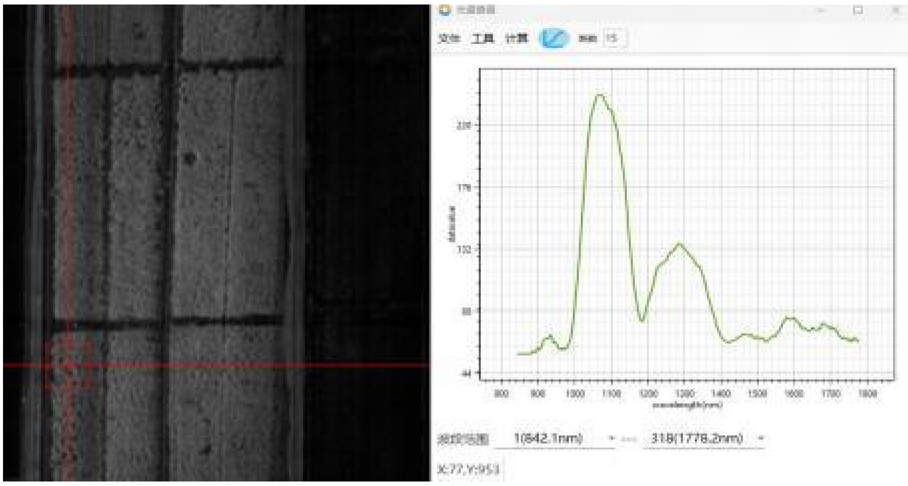

Fig. 3.3 Rice imaging results 3

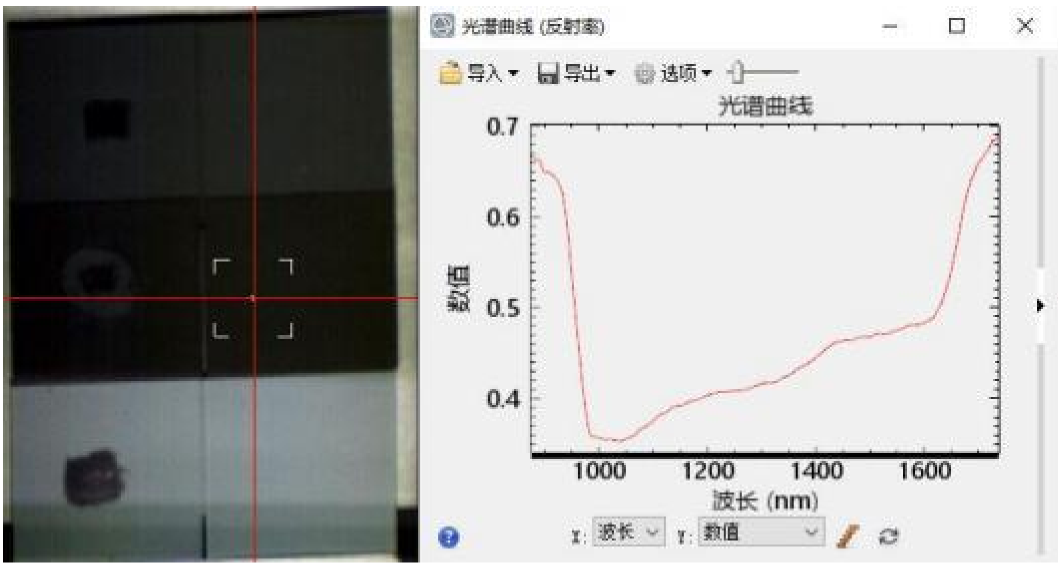

Fig.3.4 Steel imaging result 1

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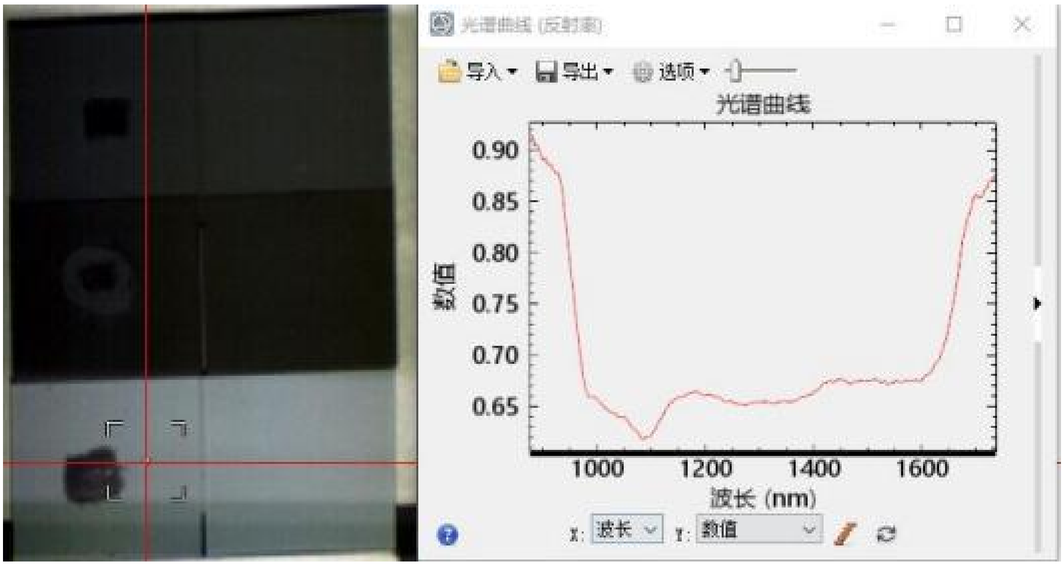

Fig.3.5 Steel imaging result 2

4. Physical & dimension drawing

Fig.4.1 Physical image ofATH101R-25 hyperspectral imager

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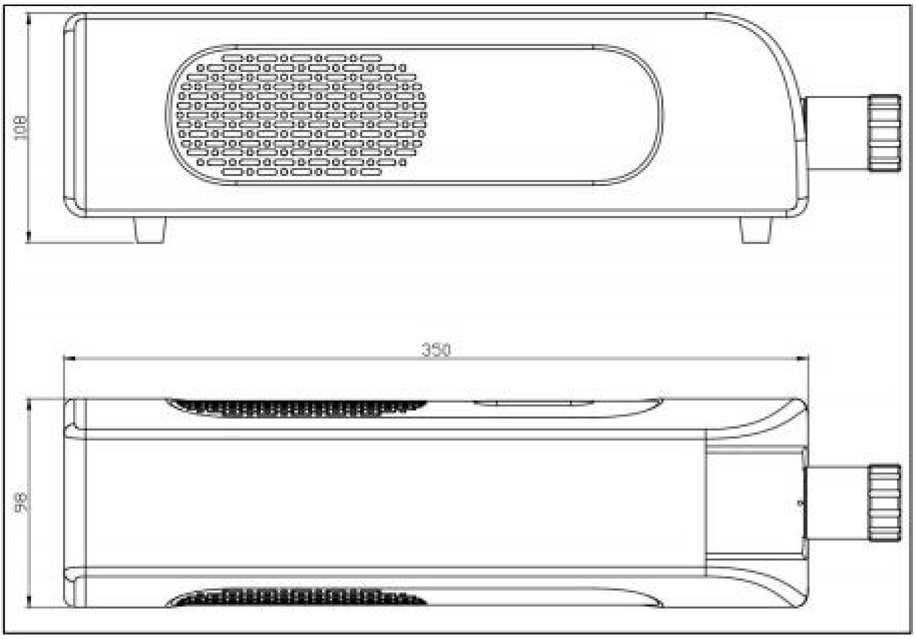

Fig. 4.2 2D Dimension drawing of ATH1010R-25

5. Shipping list and accessories

No.	Name	Specification	Quality
1	ATH1010R SWIR Hyperspectral Imager	/	1
2	Hyperspectral camera connection cable	USB3.0， 1.5m	1
3	Hyperspectral data acquisition software	/	1
4	Portable instrument case	/	1
5	Reflectance standard (diffuse reflectance white panel)	95%， 10*10cm	1
Optional accessories			
1	Halogen light source	100W	1
2	Hyperspectral acquisition platform	/	1
3	Rotating pan-tilt platform	/	1
4	Diffuse reflectance standard white panel	Depends on requirement	1
5	Tripod	/	1
6	Hyperspectral imaging objective lens	/	1
Note：The hyperspectral camera module cannot operate independently for data acquisition. Functional operation requires synchronized deployment with a scanning platform and light source.			

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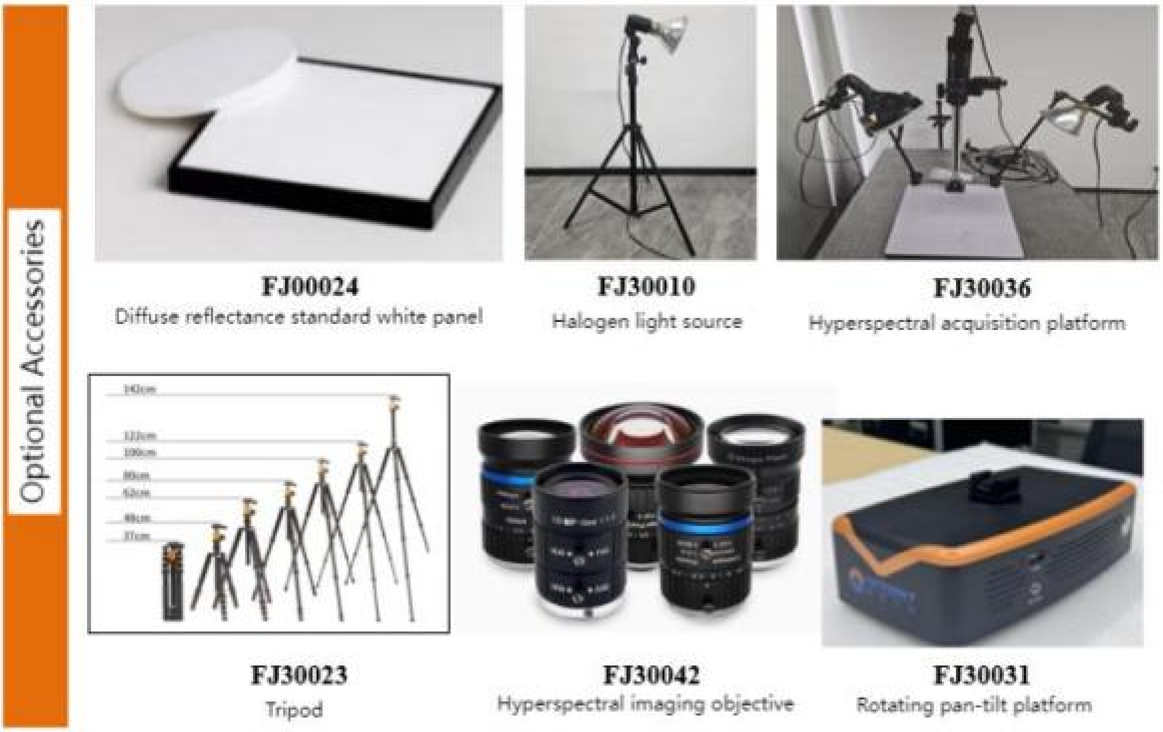

6. Application Scenarios and Measured Data

Fig.6 Indoor installation

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6.1 Geological and Mineral Resource Exploration

Hyperspectral remote sensing technology in the field of geology is mainly applied to the inversion of surface feature distribution. By identifying shared characteristic absorption peaks between unknown materials and known minerals, it can classify surface features. With its high spectral and spatial resolution and integrated imaging-spectroscopy capabilities, it enables detailed classification of terrain in mountainous and canyon regions, improving the efficiency of geological surveys and reducing risk.

The working area is mainly composed of limestone, slate, and Quaternary loess cover.By extracting aluminum hydroxyl spectral features, the distribution of slate can be preliminarily determined.By extracting carbonate spectral features, limestone distribution can be assessed.The Quaternary loess layer has no significant spectral features.

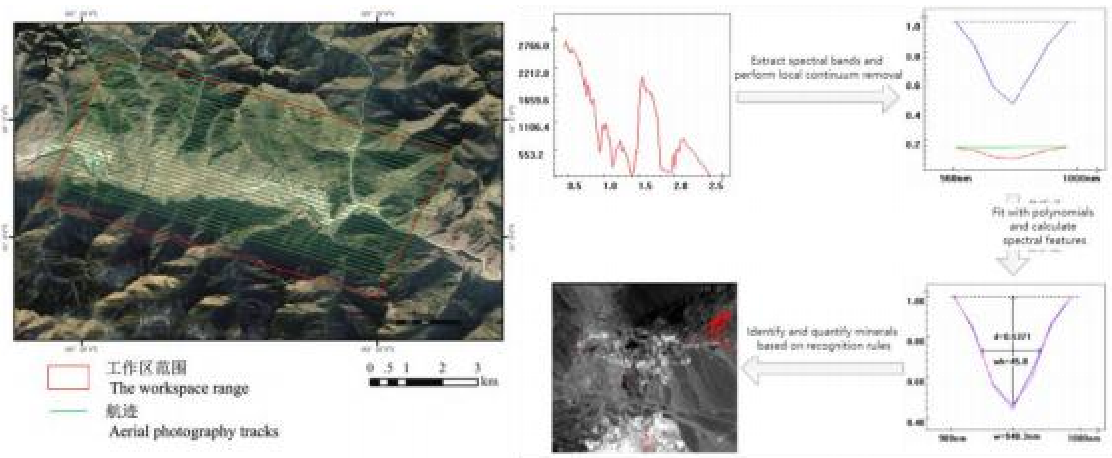
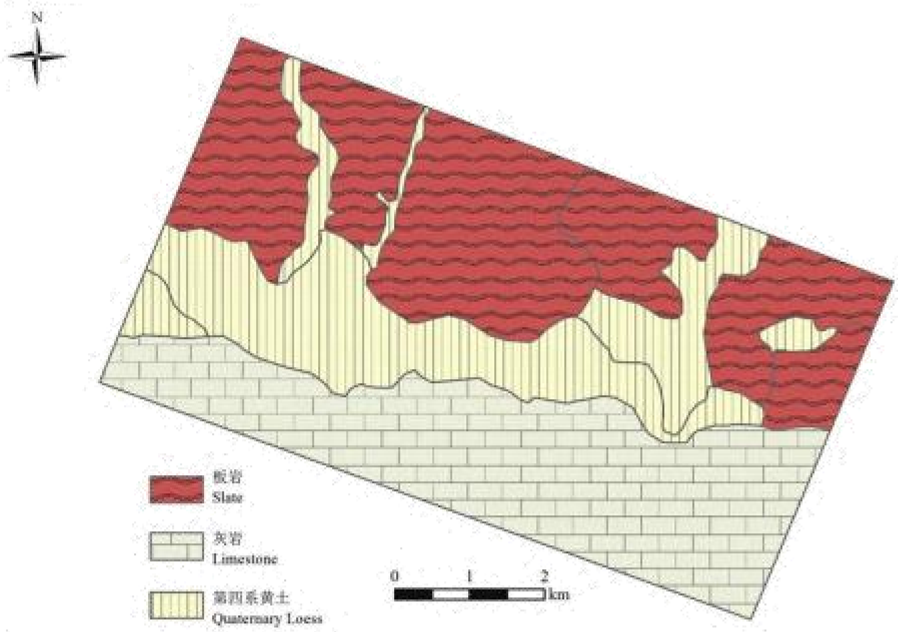


Figure 6.2 Geological Study Area (left) and Identification Process (right)



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The spectral wavelength range used for mineral mapping includes: Visible light (400–700 nm), Near-infrared (700–1000 nm), Short-wave infrared (1000–2500 nm),Thermal infrared (7000–15000 nm). Among these, the short-wave infrared region (1000–2500 nm) is most widely used in mining applications. This is because its frequencies align with the overtone and combination frequencies of chemical bond vibrations within mineral crystal lattices. Within this range, minerals containing water or OH^- (primarily phyllosilicates and clay minerals), as well as some sulfates and carbonates, can be detected.

Figure 6.4 Outdoor Display of ATH9010

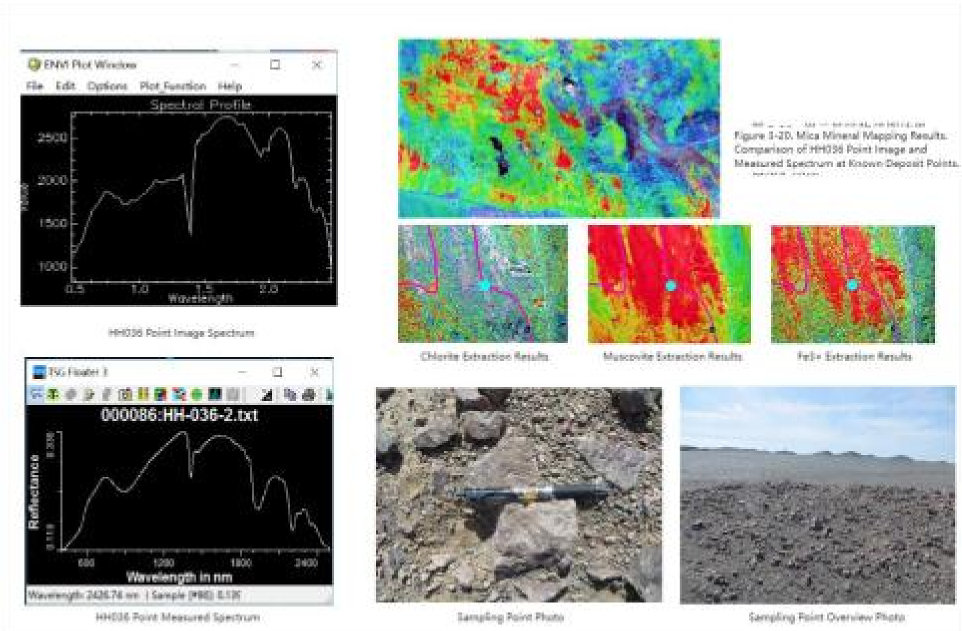

Figure 6.5 Spectral Curve of Selected Muscovite Samples

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6.2 Application in Monitoring Vegetation Growth

In recent years, with the rapid development of remote sensing technology and drone platforms, UAV-based hyperspectral remote sensing has shown great potential in vegetation growth monitoring. This technology captures detailed physiological traits of plants—such as chlorophyll content, water status, and nutrient condition—through high-resolution, narrowband spectral data, thereby assessing crop health more accurately.

Compared to traditional satellite or airborne remote sensing, drone platforms offer flexibility, low cost, and high timeliness, allowing real-time monitoring across different growth stages. This supports precision agriculture with reliable data. UAV hyperspectral imaging is also widely used in forest, grassland, and ecological environment monitoring. By constructing vegetation indices and performing multi-angle data analysis, it enables early disease warning, yield prediction, and evaluation of ecological restoration efforts.

In the future, as sensors become more compact and data processing algorithms improve, this technology is expected to play an increasingly vital role in agriculture, forestry, and ecological monitoring.

Figure 6.6 Vegetation Inversion Results from ATH9010 Hyperspectral Drone (Greener color = Healthier growth)

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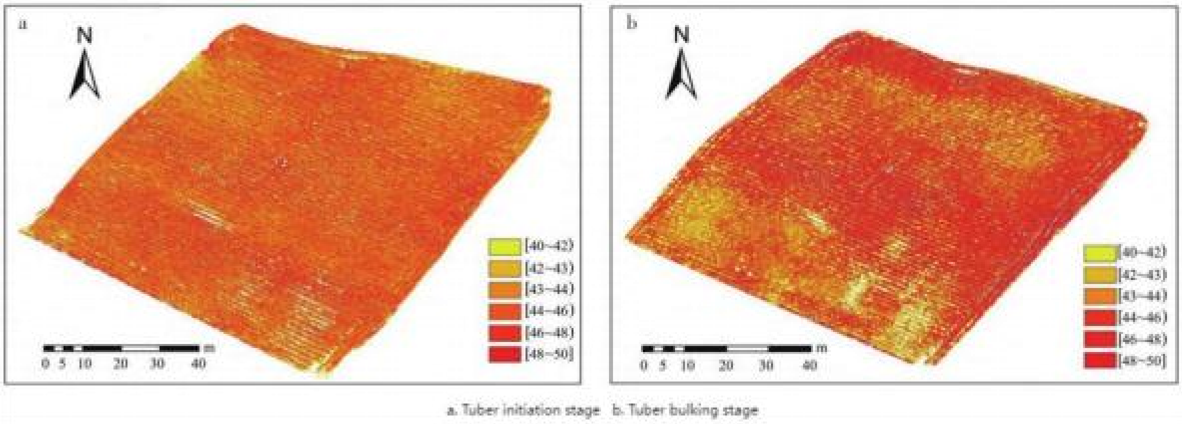

Figure 6.7 UAV Hyperspectral Study of Potato SPAD Values

6.3 Application in Forest Health Assessment

UAV hyperspectral remote sensing, with its high spectral resolution and mobility, enables close-range acquisition of multi-spectral data from forest vegetation. The continuous spectral bands in hyperspectral data capture subtle changes in vegetation reflectance, which reflect physiological and biochemical states—such as chlorophyll content, water content, and pest or disease presence.

Based on radiative transfer theory and vegetation index models, reflectance spectra can be quantitatively linked to tree health, allowing rapid assessment and early warnings. UAVs' low-altitude, high-spatial and temporal resolution capabilities allow real-time monitoring over large forest areas, offering scientific support for forest resource management, pest control, and ecological protection.

Additionally, through data fusion and multi-temporal monitoring, the accuracy of monitoring can be improved, and dynamic trends in forest health can be tracked. This provides effective support for decision-makers and helps ensure the long-term stability of forest ecosystems.

Principle: Vegetation health correlates with greenness index, leaf area index, leaf water content, and light use efficiency.

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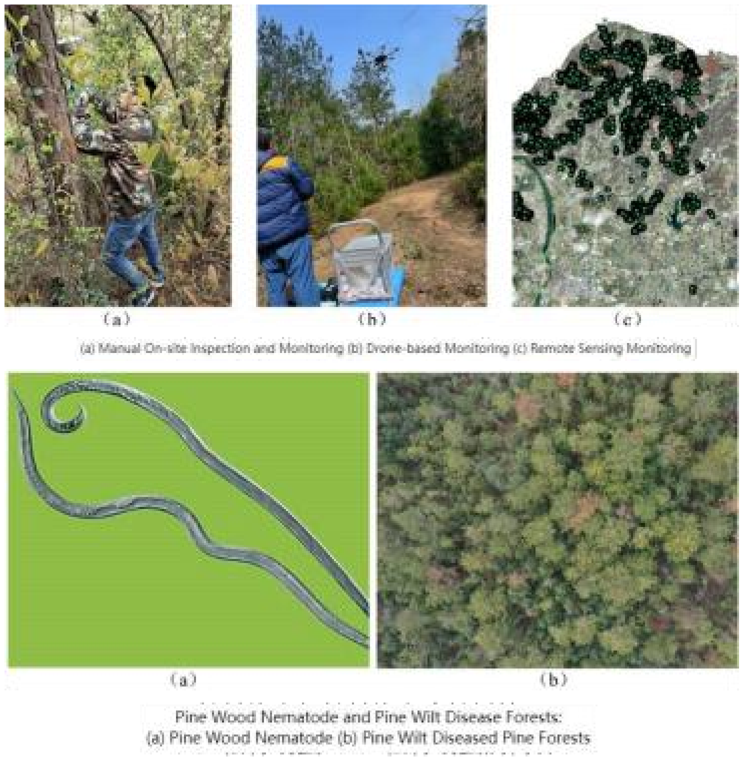

Figure 6.8 Hyperspectral Imaging Study of Masson Pine Health

6.4 Application in Forest Fire Prevention

Drones equipped with hyperspectral remote sensors provide solid theoretical support for forest fire prevention through their high spectral and spatial resolution imaging capabilities. This technology leverages the differences in reflectance across wavelengths for various materials—such as vegetation, soil, and fuels—allowing for the early detection of fire hazards through precise spectral analysis.

Using vegetation indices, drought indices, and other spectral algorithms, dynamic monitoring of forest areas can be conducted. This enables detection of dry vegetation, pest infestations, and other fire risk indicators, along with assessment of combustibility.

UAVs offer agile, low-altitude flight capabilities, overcoming the spatiotemporal resolution limitations of traditional satellite remote sensing. With its theoretical and technical advantages, hyperspectral remote sensing provides scientific backing for fire warning, emergency response, and resource management—facilitating early detection and precise localization of fire risks and safeguarding forest ecological security.

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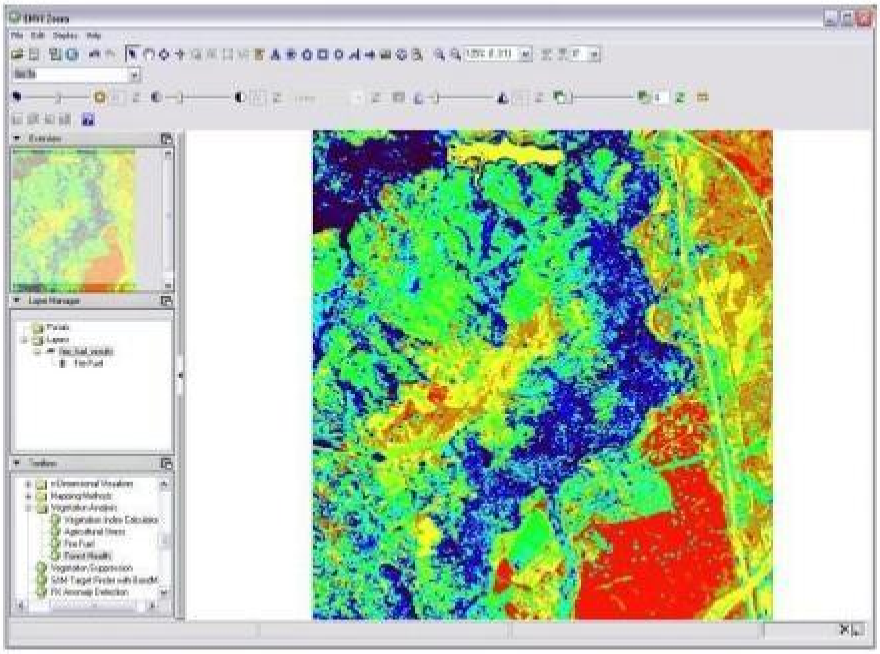

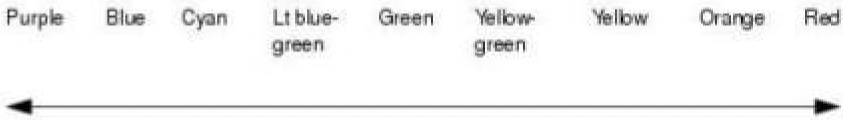

Figure 6.9 Application of Hyperspectral Imaging in Forest Fire Prevention

6.5 Medical Microscope Imaging Spectroscopy Applications

Application Objective: Intraoperative real-time detection and navigation during tumor surgery.

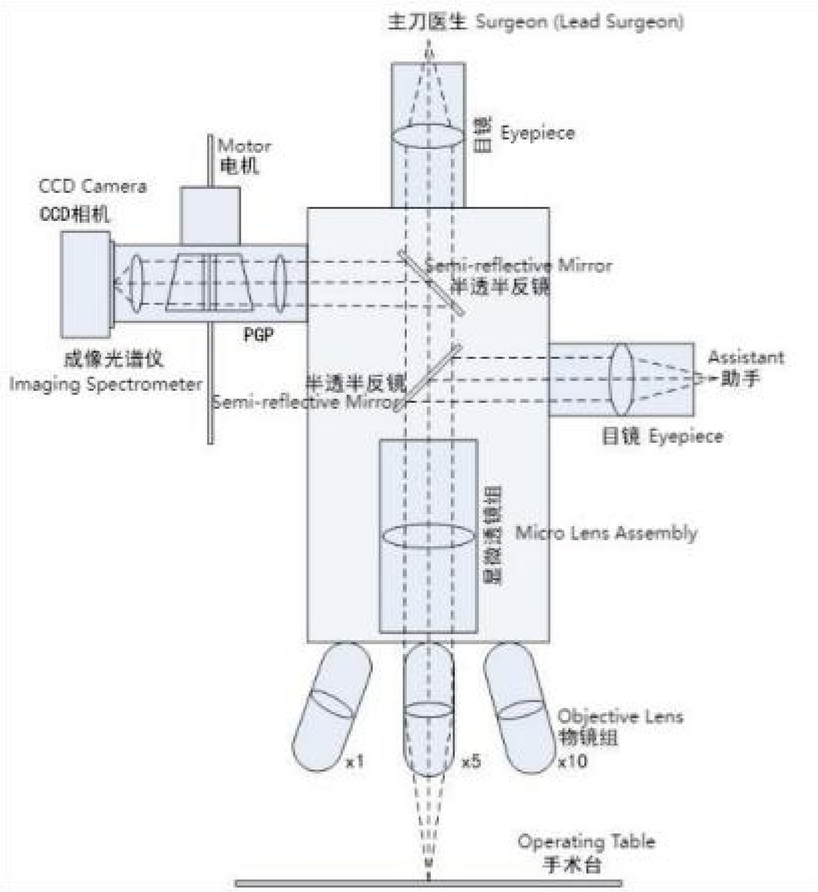

Figure 6. 10 Schematic Diagram of Optical Path in Medical Microscope Imaging Spectrometer

The diagram illustrates the principle of a medical microscope imaging spectrometer. The target on the operating table is split into three paths after passing through the objective lens and the microscope lens group: one for the primary surgeon's visual observation, another for the assistant's visual observation, and the third to the imaging spectrometer. The imaging spectrometer scans the spatial dimensions of the target via a motor, acquiring its hyperspectral imaging data. After data analysis and image processing, the results are displayed on a monitor for the surgeon.

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Figure 6.11 Physical Image of Medical Microscope Imaging Spectrometer

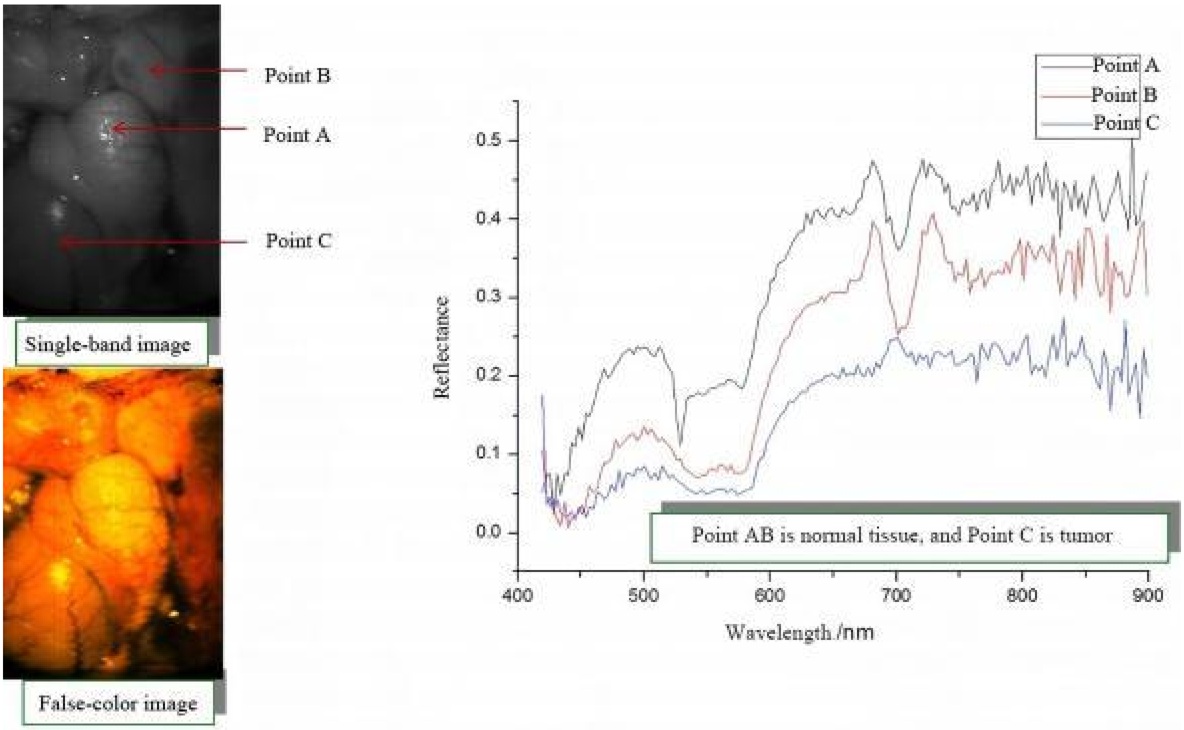

Figure 6. 12 Spectral Data from the Medical Microscope Imaging Spectrometer

6.6 Airborne Imaging Spectroscopy Applications

UAV (drone)-based hyperspectral remote sensing technology relies on spectral recognition principles. It captures the reflection and radiation information of surface materials across continuous spectral bands to accurately identify surface composition, structure, and changes.

The theoretical basis includes:

Spectral quantitative analysis—extracting physical and chemical parameters using band-rich hyperspectral data through spectral matching and inversion algorithms.

Integration of high spatial and spectral resolution—capturing fine spatial features while preserving spectral detail.

Sensor radiometric calibration and atmospheric correction—eliminating instrument errors and atmospheric interference to improve data accuracy.

Advanced data processing and pattern recognition—achieving high-accuracy target recognition and quantitative analysis using multidimensional data fusion and intelligent classification techniques.

In addition, the UAV platform offers advantages such as low-altitude operation, flexibility, and high temporal-spatial resolution, making hyperspectral imaging widely applicable in geological exploration, agricultural monitoring, and environmental assessment.

The diagram shows an airborne imaging spectrometer based on the SpecVIEW-VIS system, composed of SpecVIEW-VIS, a stabilized platform, and a POS (position and orientation system) module.

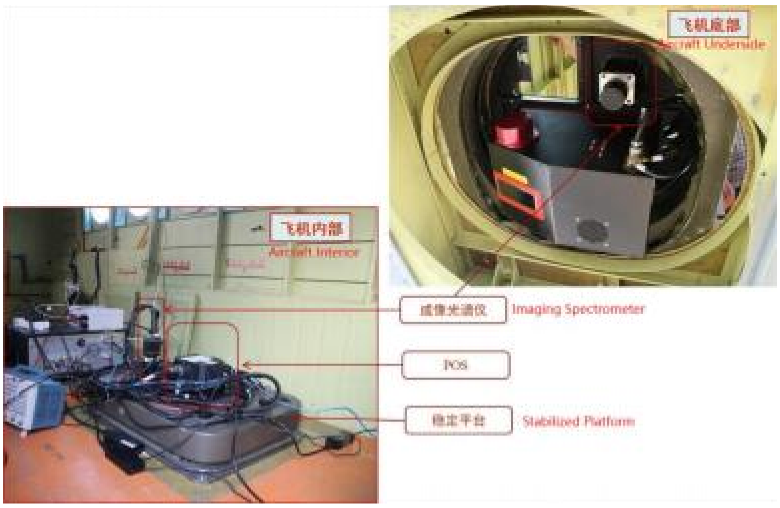

Figure 6.13 Airborne Remote Sensing Application

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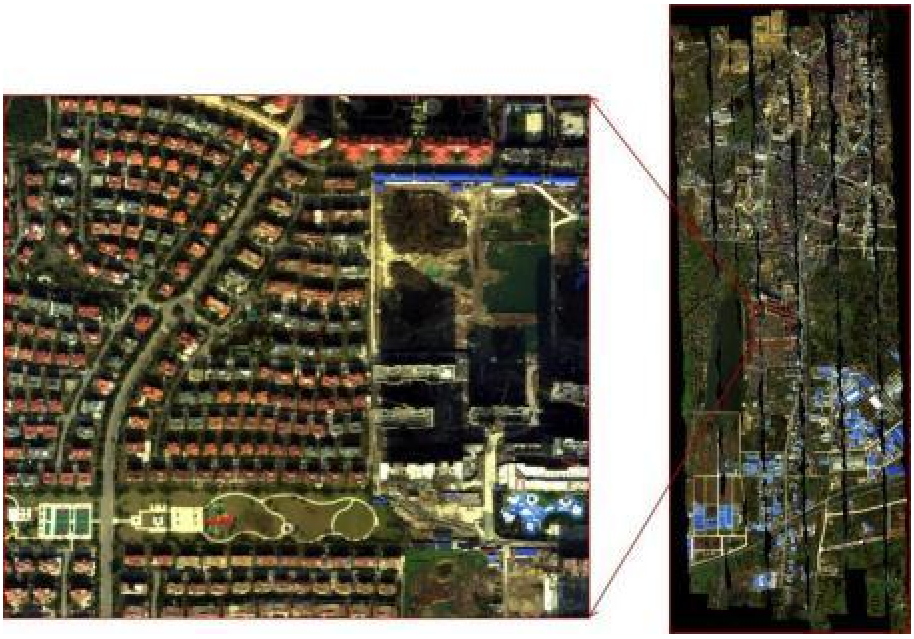

Figure 6. 14 Airborne Application Data – Pseudo-color Image

The following image shows data acquired by the instrument during a flight over Jingmen, Hubei, in December 2014. The upper image is a pseudo-color image after geometric correction, flight strip stitching, and radiometric correction. The lower part shows spectral curves of typical ground objects.

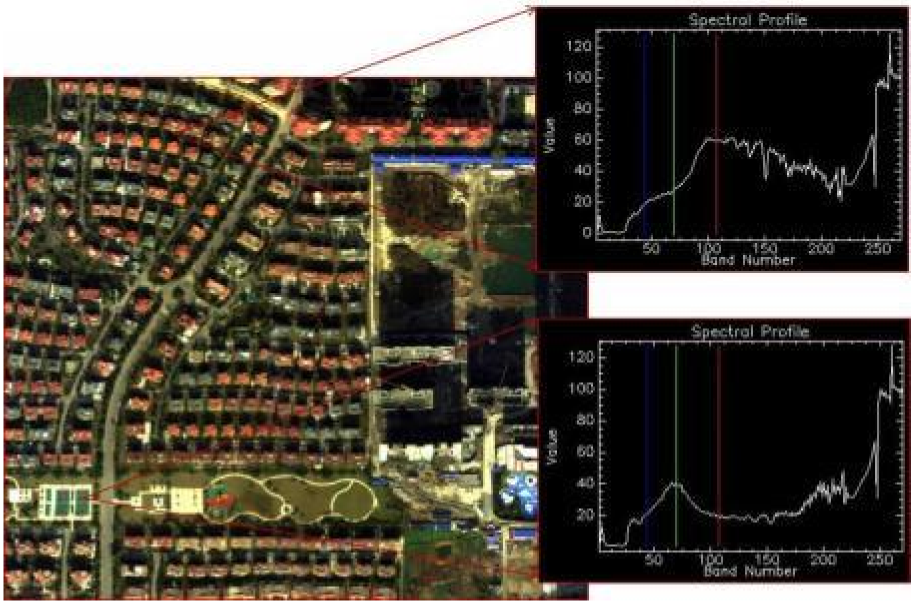

Figure 6. 15 Airborne Application Data – Spectral Curves

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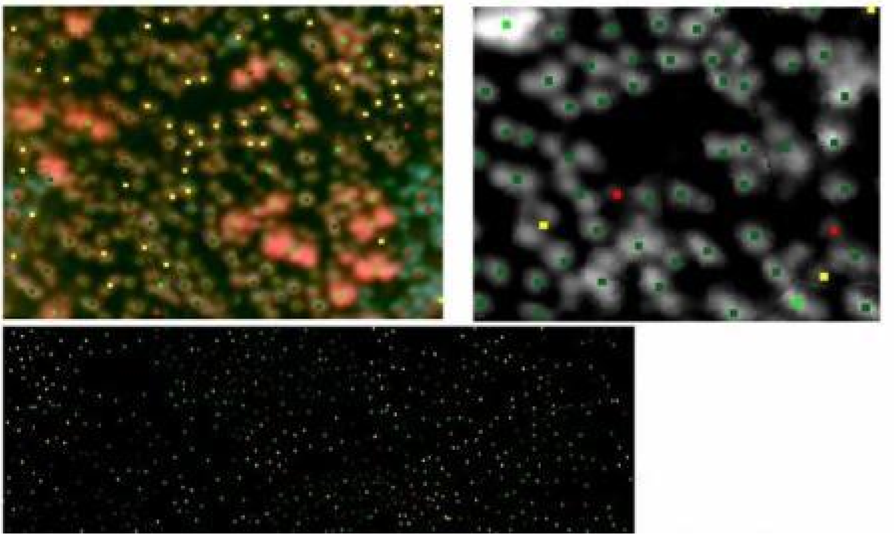

Figure 6. 16 Forest Remote Sensing – Airborne Hyperspectral Observation of Forest Pests and Diseases

6.7 Plastic Sorting

In plastic sorting, instruments equipped with hyperspectral sensors leverage the precise acquisition and analysis of material spectral characteristics based on hyperspectral remote sensing technology.

Due to differences in chemical composition and molecular structure, plastics exhibit distinct reflectance and absorption spectra—forming unique "spectral fingerprints"—across electromagnetic wavebands. As the conveyor moves, the sensor collects continuous hyperspectral data in NIR and SWIR bands from various plastics in the target area. Using radiative transfer theory and atmospheric correction, environmental interferences are reduced, revealing the true spectral information.

Spectral feature extraction, principal component analysis, and machine learning classification algorithms are then employed to match and classify different plastics (e.g., polyethylene, polypropylene, polystyrene), enabling precise sorting.

This method is real-time, highly accurate, and supports wide operational coverage, providing a scientific and technical basis for recycling waste plastics, environmental monitoring, and resource reuse.

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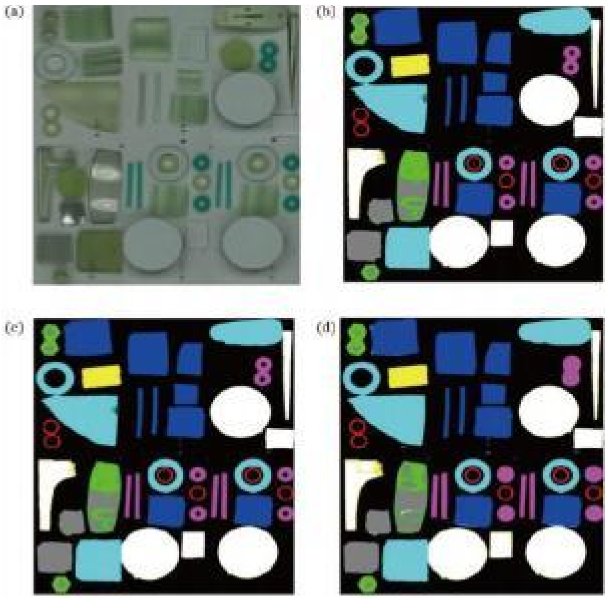

Figure 6. 17 Classification Performance Comparison ofK-NN Based on Euclidean, Cosine, and SAM Distances

6.8 Food Classification – Eggs

A hyperspectral imaging system integrates imaging and spectroscopy to simultaneously acquire spatial and spectral information. In the classification of eggs, different varieties or quality levels—due to differences in growth environment, rearing conditions, and freshness—exhibit subtle but measurable spectral differences in shell color, texture, and internal chemical composition.

By precisely collecting reflectance and absorption spectra from the egg's surface and interior, the hyperspectral imager provides continuous spectral band data reflecting physical and chemical characteristics.

Through statistical analysis and pattern recognition of large sample datasets, an egg spectral database can be built. Multivariate statistical analysis and machine learning algorithms then allow for automatic identification and accurate classification.

This approach enables non-destructive, rapid online detection, improving sorting accuracy and efficiency while reducing human error. As such, hyperspectral imaging plays a key role in egg quality control and advances intelligent, modern food safety inspection.

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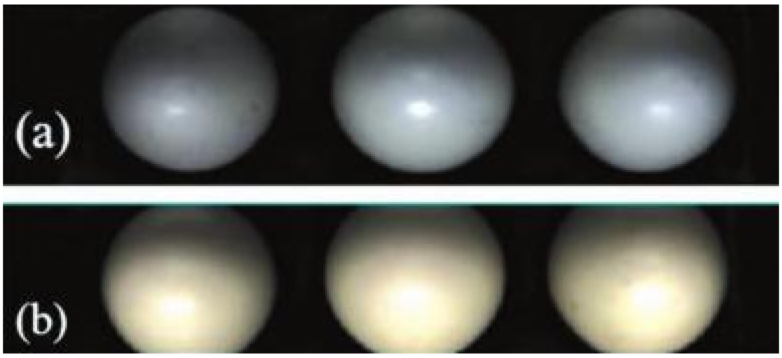

Figure 6.18 Spectral Image Black-and-White Calibration
(a) Original Spectral Image; (b) Image after Black-and-White Calibration

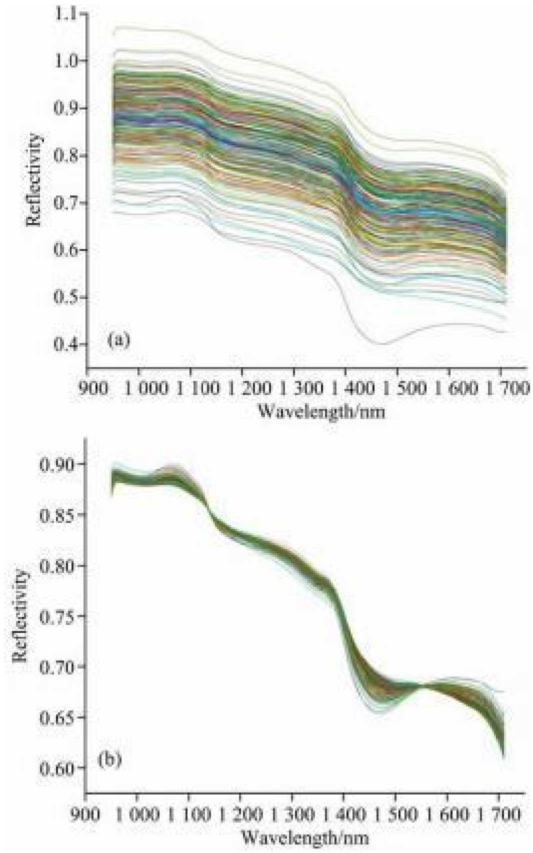

Figure 6. 19 Preprocessed Average Reflectance Curve
(a) SG (Savitzky–Golay) Preprocessing; (b) MSC (Multiplicative Scatter Correction) Preprocessing

6.9 Rapid Environmental Monitoring and Evidence Collection

Illegal dumping of solid waste frequently occurs in idle plots and "three-edge" zones—mountainsides, forest edges, and riverbanks—at provincial borders. This poses threats to water and soil quality and public health.

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Drones conducting high-altitude grid inspections, equipped with zoom visible-light cameras, can provide comprehensive views of farmlands, forests, and wastelands. Infrared cameras focus on rivers and forested or concealed areas, helping regulatory agencies quickly locate illegal dumping sites and capture high-resolution evidence.

By analyzing aerial images through a software platform, suspected illegal waste disposal sites in key areas—like Pukou District—can be dynamically identified, supporting field enforcement and decision-making with foundational data.

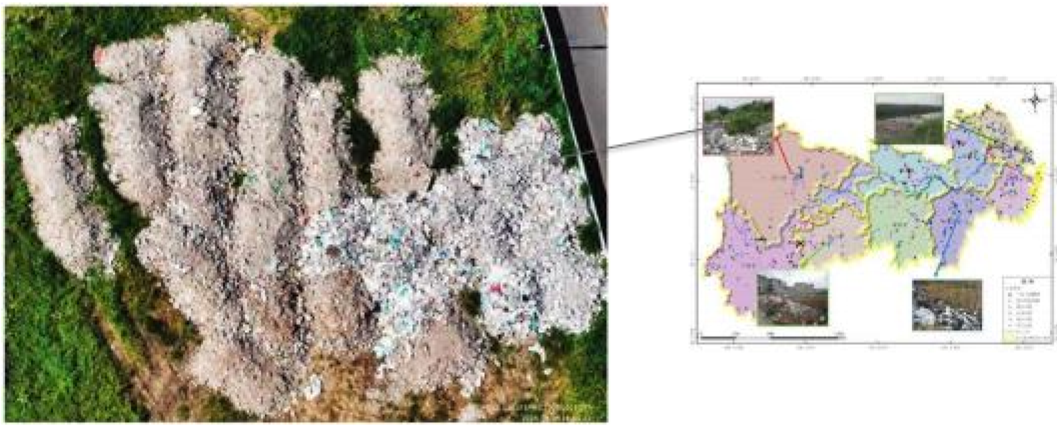

Figure 6.20 Drone-Captured Evidence of Illegal Solid Waste Dumping

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