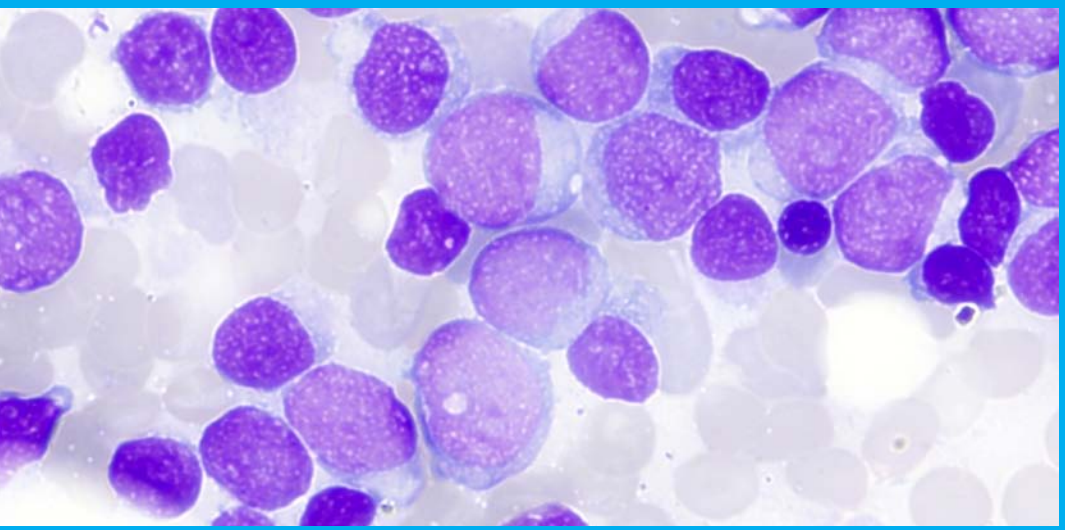
Morphogo

Bone Marrow
Cell Morphology Analysis System



www.morphogo.com

ABOUT ZHIWEI

Hangzhou ZhiWei Information Technology Co. Ltd is an industry pioneer in the application of artificial intelligence to cytopathology. Through cutting-edge technological innovation, the company provides artificial intelligence solutions for cytopathology to global customers. Headquartered in Hangzhou City, the company has wholly-owned subsidiaries in the United States, Hungary, Australia, and China (Hong Kong and Zhejiang province.

ZhiWei is dedicated to long-term independent research and development. So far, over 20 international PCT patents and domestic patents have been granted. Through the technological enhancement of a decade, ZhiWei has reached a world-leading position in bone marrow cell morphology analysis, one of the most-challenging directions of AI-aided diagnoses in the field of cytopathology.

By overcoming the challenges of automated bone marrow aspirate smear scanning and AI-aided nucleated cells recognition algorithms, ZhiWei is the first company that launched a fully automated bone marrow cell morphology analysis and diagnosis system (Morphogo) globally

and completed the product registration in China, Japan, European Union, Australia, and the United Kingdom, expanding its business across thirty countries around the world.

By devoting to the mission of “revolutionize medical diagnostics with artificial intelligence”, ZhiWei will forge ahead, explore new breakthroughs, and promote clinical pathology into a new era of automation, standardization, digitization, and intellectualization.

Patents
25+

Countries covered
30+

Partners
80+

Cell database
9000000+

INTRODUCTION TO MORPHOGO

Morphological evaluation of bone marrow cells

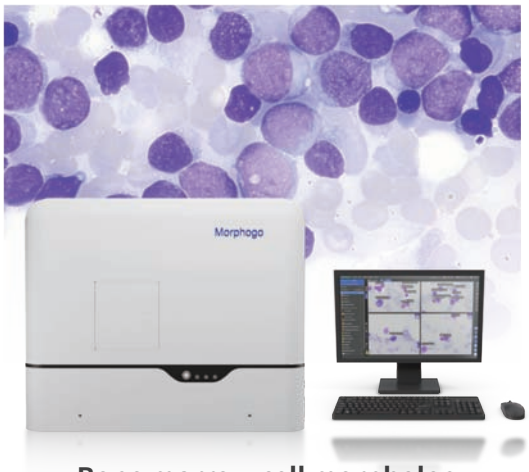
The morphological evaluation of bone marrow cells is fundamental for the diagnosis of blood disorders een low-power and high-power objective lenses and perform differential cell counts under oil immersion lens when examining bone marrow slides. This is a time-consuming, tedious, and subjective process.

The digitization of bone marrow aspirate smears is a world-class technical challenge and has been the research and development focus of top international IVD companies for over decades.Through years of effort, ZhiWei has finally commercialized the world' s first bone marrow cell morphology analysis system (Morphogo).

About Morphogo

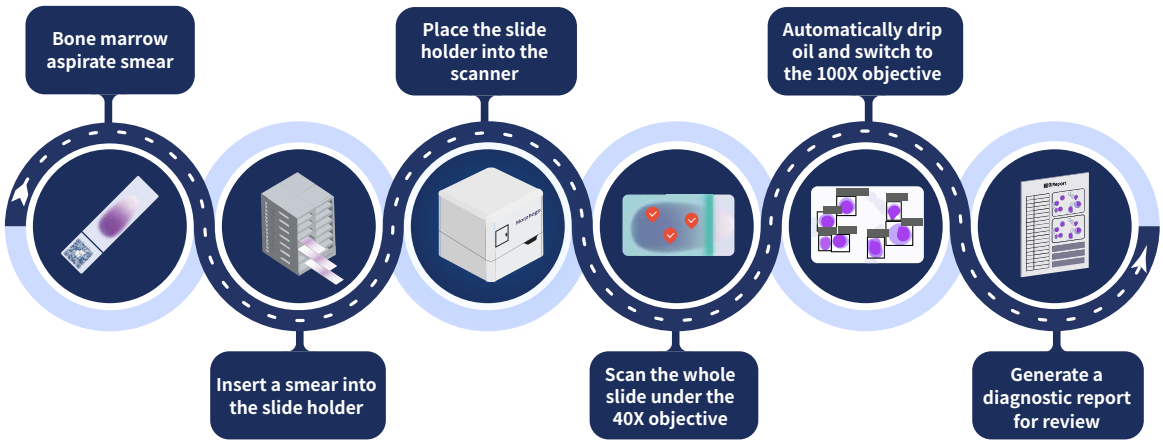
Morphogo is a world-leading bone marrow cell morphology analysis system that offers a complete solution for the morphological evaluation of bone marrow cells. It can fully automate standard bone marrow examination workflow.

- First, the 40X high-power objective will scan the entire slide, locate all nucleated cells (over millions) and count all megakaryocytes. A full-field digital bone marrow aspirate smear is generated to cover every diagnostically significant cell.
- Then, the system will automatically select the region of interest and switch to the 100X oil lens after dripping immersion oil, perform the differential cell count and automatically generate a diagnostic report.
- Morphogo provides fast and accurate secondary acquisition function for any section of the smear.



Bone marrow cell morphology analysis system

Fully automated workflow



PRODUCT DESCRIPTION AND TECHNICAL SPECIFICATION

Morphogo has 5 main components: Smear Acquisition System, Data Review System, Data Analysis System, Project Information Management System and Data Management Server.

Bone Marrow Cell Morphology Smear Acquisition System

Preview the full slide under 1X objective and scan the whole slide under 40X objective; use AI algorithms to identify the regions of interest followed by automatic oil dripping; finally, switch to the 100X oil lens to obtain ultra-high resolution digital images.

Bone Marrow Cell Morphology Data Analysis System

Create projects, automatically locate and pre-classify the nucleated cells on the digital smear generated by the smear acquisition system; perform a differential cell count based on the pre-classification results.

Bone Marrow Cell Morphology Data Review System

Review the cell pre-classification results and the automated differential cell count generated by the data analysis system; integrate the information into the standard report template and sign out the final diagnostic report.

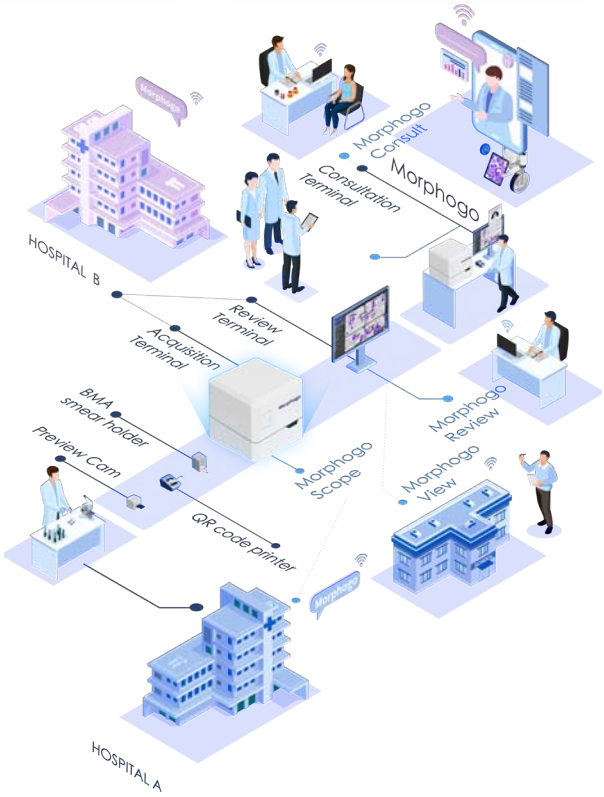
Project Information Management System

View all reviewed projects in the system; perform data management and export project data.

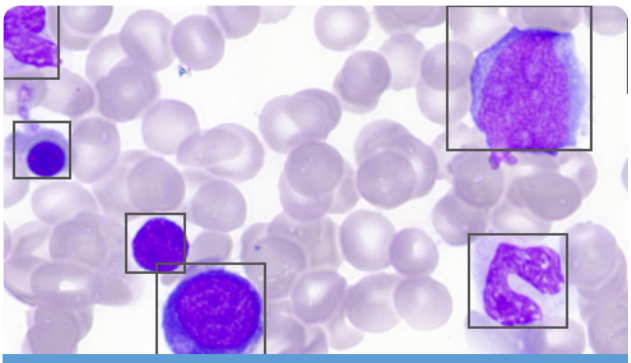
Data Management Server

Customize a local storage system for digital bone marrow smears and provide stable data management to safeguard hospitals' medical information.

Description	Parameters
Slide size	Long :75mm, tolerance (0~-1)mm; Width:26mm, tolerance (0~-1)mm; Height:1.1mm, tolerance (0-1)mm
Maximum slide scan range	>44mm*22mm
100X scan speed	⩽1.5s/view
40X scan resolution	0.037 (±0.005) μm/Pixel
Image format	Jpg, tif, png, bmp
Storage	Up to 128T local storage
Pre-classifiable cell lineages	Granulocytic, erythroid, lymphocytic, monocytic, plasma cells and megakaryocytic
Cell differential statitstics	ANC, NEC, NEC, SC and NMNC
Scanner size	W*D*H:<800mm*800mm*717.5mm
Throughput	⩾25

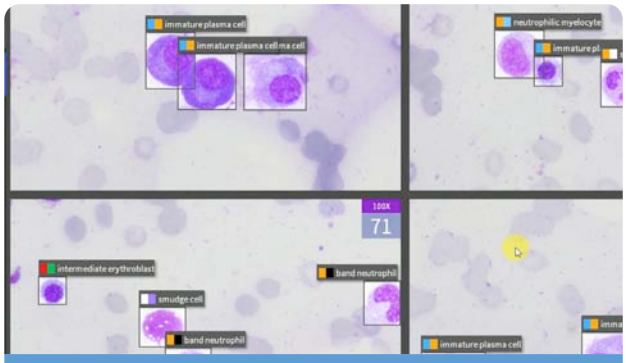


PRODUCT FEATURES



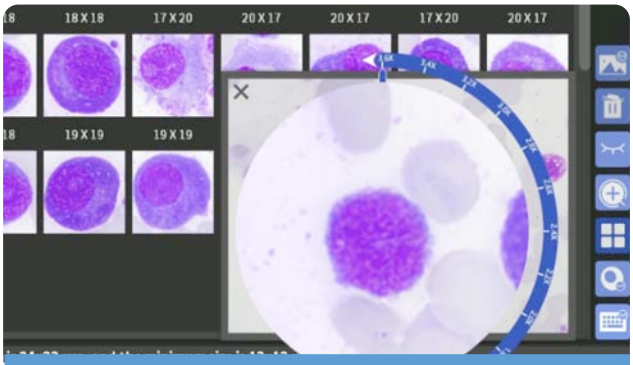
Precise cell extraction

Locate and extract nucleated cells in bone marrow smears, with a **99%** cell extraction rate.



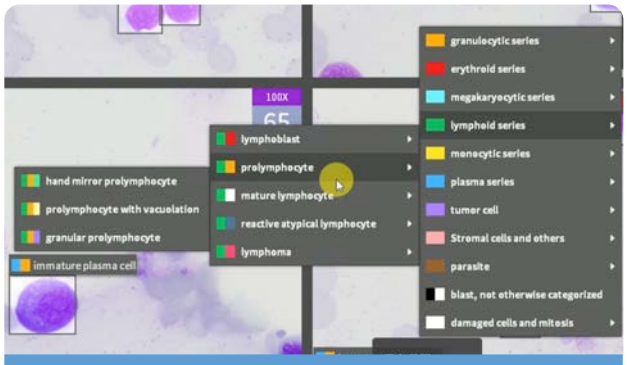
Intelligent cell recognition

Nucleated cells are scanned at an ultra-resolution of 100X. A 27-layered convolutional neural network can accurately recognize and classify the located nucleated cells, with an overall accuracy of over **83%**.



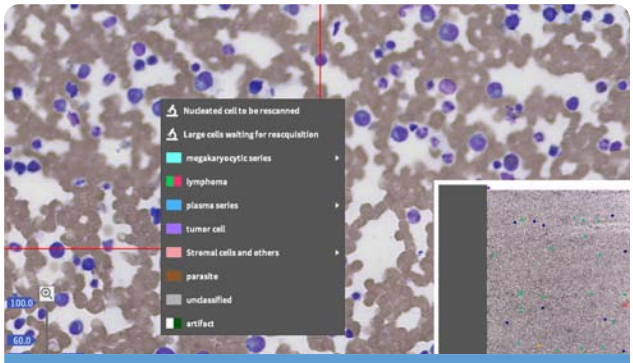
Fast zoom mode

Zoom up to **3600X** cell enlargement for easy observation of cytoplasmic granules, chromatins and nuclei, bacteria, parasites, and other important diagnostic morphological features.



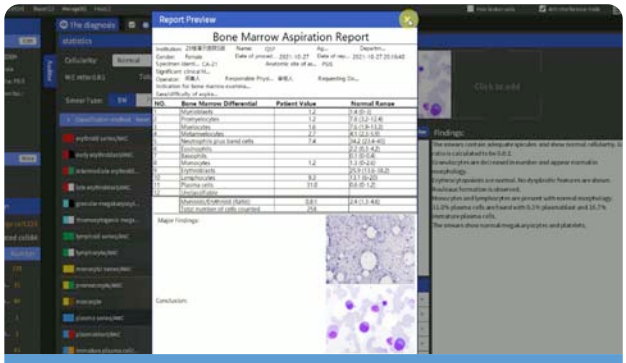
Smart classification review

The cell recognition algorithm provides the five most likely cell types with the corresponding cell characteristics (**Top 5 function**), covering over **97%** of the possibilities to facilitate corrections.



High-resolution secondary acquisition

Precisely locate the area requested by pathologists for a secondary acquisition and capture high-definition cell images with the 100X oil lens to fully satisfy the needs for supplementary information.



Comprehensive report generation

Morphogo supports ANC, NEC and other cell classification statistics to automatically generate diagnostic opinions and assist pathologists to complete the diagnostic process efficiently.

PRODUCT ADVANTAGES

Patented innovative technologies

- World-leading microscopic imaging system (full slide scanning at 40X magnification with 0.17μm/pixel scan resolution; ROI acquisition at 100X magnification with 0.037μm/pixel scan resolution)
- Unique multi-layered focusing technique (scan and merge multiple images taken at different focal distances to generate high-resolution cell images)
- Breakthrough focal plane control technique (reduce the focal plane fluctuations to less than 0.3μm)

Accurate cell recognition

- AI-aided image recognition with deep learning
- Over 40+ cell classification types, enabling accurate morphology evaluation
- A database with over 9 million well labelled nucleated cells, all annotated by top pathologists

Easy to operate

- A fully automated solution comparable to the clinical diagnostic process
- Cell extraction of up to 9,999 units under the 100X oil lens
- Multiple slide navigation modes and convenient tools including batch classification of nucleated cells, shortcut cell classification, magnifier, etc

Reliable whole slide imaging

- 40X whole slide imaging in less than 5 minutes
- Full slide megakaryocyte counting
- Digital slide storage

Personalized diagnostic reports

- Automatic retrieval of cell count results
- Flexible selection of representative diagnostic images
- Generation of diagnostic reports with personalized templates

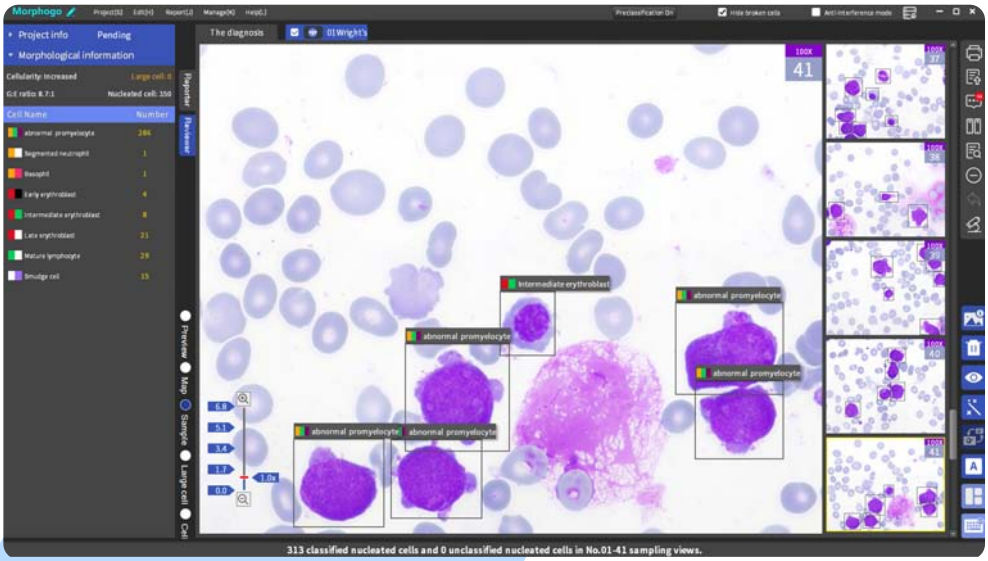
Broader range of applications

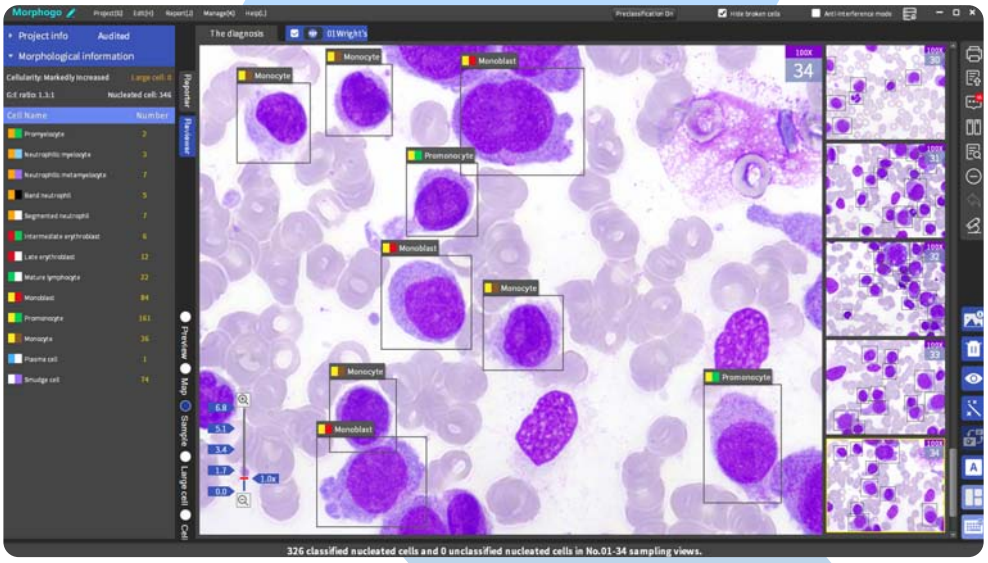
- Digitized interactive cell morphology education
- Telepathology with whole slide imaging
- Digital preservation and sharing of special clinical cases
- Innovative clinical research empowered by cutting-edge AI technology

CASE DEMONSTRATION

Acute promyelocytic leukaemia (AML-M3)

This smear contains a high number of abnormal promyelocytes, with irregular nuclear contours, hypergranulation and cytoplasmic protrusions.



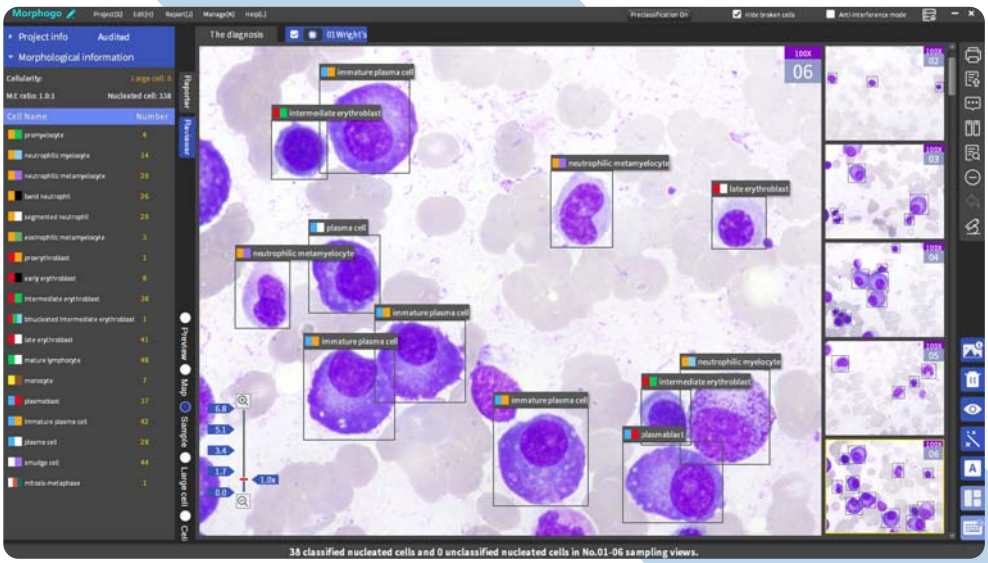


Acute monocytic leukaemia (AML-M5)

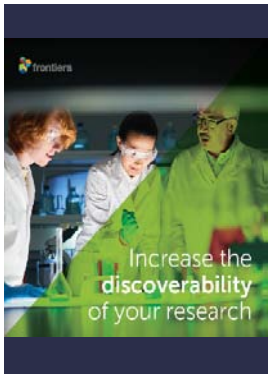
A high number of immature monocytes can be seen in the bone marrow. They have relatively large cell sizes. The nucleus is indented with fine chromatin and distinct nucleoli. The cytoplasm is blue-grey, and a few purple-red granules can be seen.

Multiple Myeloma (MM)

A high number of plasma cells at different stages can be observed in this smear, which are characterized by abundant deep blue cytoplasm and round and eccentrically placed nuclei. Occasionally nucleoli can be seen.



RESEARCH



frontiers

Detection of metastatic tumor cells in the bone marrow aspirate smears by artificial intelligence (AI)-based Morphogo system

Pu Chen[1], Run Chen Xu[2], Nan Chen[1],Lan Zhang[1], Li Zhang[1], Jianfeng Zhu[1], Boshen Pan[1,3,4], Beili Wang*[1,3,4], Wei Guo*[1,3,4]

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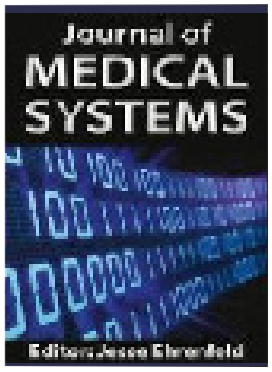


Journal of Medical Systems (2020) 44: 184
https://doi.org/10.1007/s10916-020-01654-y

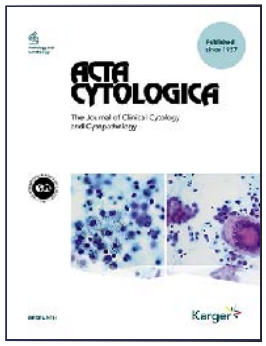
IMAGE & SIGNAL PROCESSING

Check for updates

Developing and Preliminary Validating an Automatic Cell Classification System for Bone Marrow Smears: a Pilot Study

Hong Jin[1] · Xinyan Fu[2] · Xinyi Cao[2] · Mingxia Sun[2] · Xiaofen Wang[1] · Yuhong Zhong[1] · Suwen Yang[1] · Chao Qi[1] · Bo Peng[2] · Xin He[3] · Fei He[3] · Yongfang Jiang[3] · Haiyan Gao[1,3] · Shun Li[4] · Zhen Huang[4] · Qiang Li[4] · Fengqi Fang[5] · Jun Zhang[1]

Received: 15 July 2020 / Accepted: 25 August 2020 / Published online: 7 September 2020



Acta Cytologica

Commentary

Acta Cytologica 2021;65:354–357
DOI: 10.1159/000518382

Received: May 31, 2021
Accepted: July 7, 2021
Published online: July 20, 2021

A Machine Learning Tool Using Digital Microscopy (Morphogo) for the Identification of Abnormal Lymphocytes in the Bone Marrow

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PATENTS

National Patent (Part)

No.	Name	Patent Type
1	Bone Marrow Cell Labeling Method and System	Invention
2	An Interactive Method for the Bone Marrow Examination Software to Quickly Find Abnormal Cells	Invention
3	An Interactive Method for Quickly Correct Bone Marrow Nucleated Cell Classification	Invention
4	A Slide Holder	Invention
5	An Automated Slide Detection System	Invention
6	An Automated Slide Loading System	Invention
7	A Saturation-based Clustering Method for Localizing Bone Marrow Leukocytes	Invention

PCT Patent (Part)

No.	Name	Patent Type
1	骨髓细胞标记方法及びシステム	Japanese Invention
2	Bone marrow cell marking method and system	Russian Invention
3	Saturation clustering-based method for positioning bone marrow white blood cells.	Australian Invention
4	Process method for bone marrow smear digitization	Australian Invention

Morphogo has successfully completed the product registration in China, Japan, Europe, the United Kingdom and Australia.


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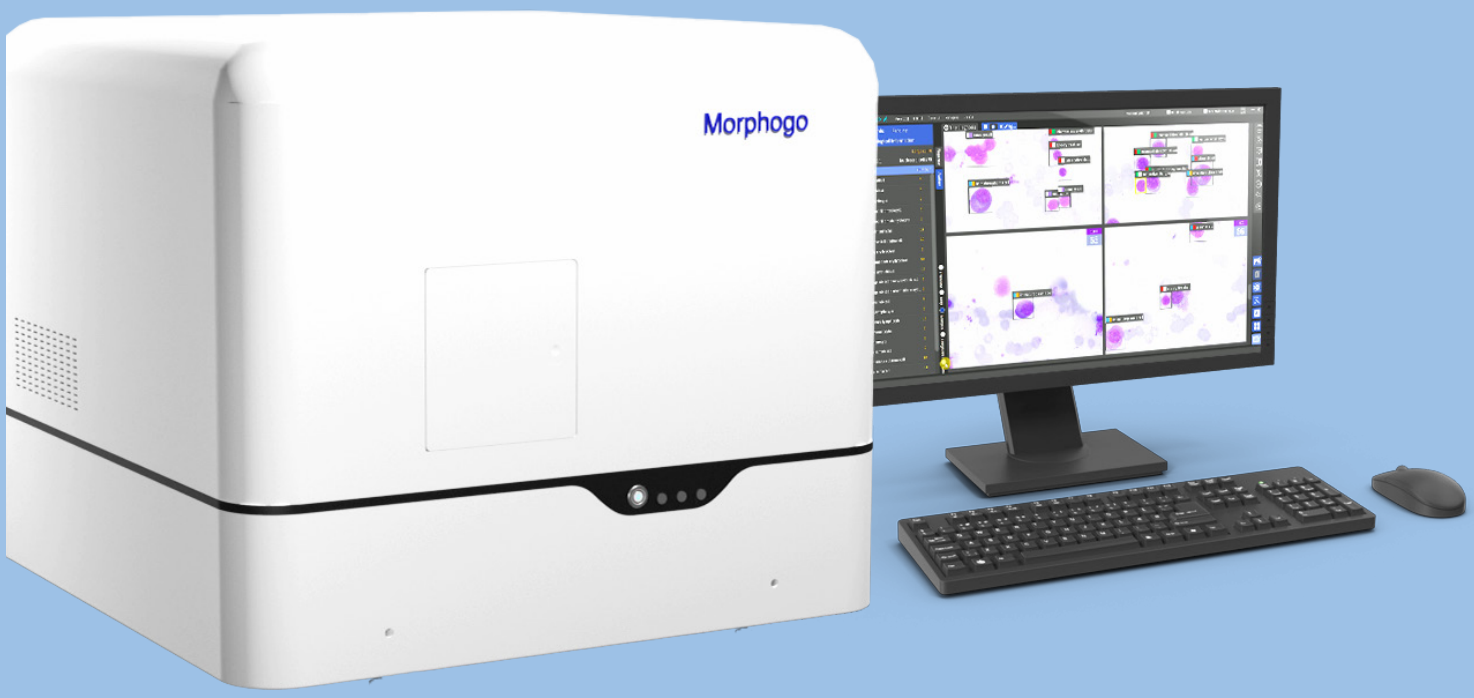
MAYO CLINIC
Helios

Revolutionize medical diagnostics with artificial intelligence



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