



Le Ministre de l'Économie,

Vu la loi du 20 juillet 1992 portant modification du régime des brevets d'invention, telle que modifiée ;

Vu le règlement grand-ducal du 17 novembre 1997 concernant la procédure et les formalités administratives en matière de brevets d'invention ;

Vu le dépôt de la demande de brevet luxembourgeois daté du : **03/12/2021** ;

Arrête :

Art. 1er.- Il est délivré à la (aux) personne(s) mentionnée(s) sur le tableau des données bibliographiques attaché au présent arrêté, sous le numéro de code 73, un

BREVET D'INVENTION N° LU500955

pour : Image Recognition Method and System for Natural Disasters in Power Transmission Corridor tel que décrit dans les duplicata des pièces techniques joints en annexe.

Art. 2.- Le brevet est délivré sans examen préalable de la brevetabilité de l'invention, sans garantie de l'exactitude de la description et aux risques et périls des demandeurs.

Art. 3.- Le présent arrêté, qui constitue le titre de protection, est expédié au(x) mandataire(s) agréé(s), mentionné(s) sur le tableau des données bibliographiques attaché au présent arrêté, sous le numéro de code 74 ou, à défaut, à la (aux) personne(s) visées(s) à l'article 1er, pour servir de document probant à celle(s)-ci.

Luxembourg, le **03/06/2022**

Pour le Ministre de l'Économie,

Corinne Müller
Attachée
Office de la propriété intellectuelle

19



LE GOUVERNEMENT
DU GRAND-DUCHÉ DE LUXEMBOURG
Ministère de l'Économie

11

N° de publication :

LU500955

12

BREVET D'INVENTION

B1

21

N° de dépôt: LU500955

51

Int. Cl.:
G06Q 10/06, G06K 9/62

22

Date de dépôt: 03/12/2021

30

Priorité:

72

Inventeur(s):
TAO Hui - Chine

43

Date de mise à disposition du public: 03/06/2022

74

Mandataire(s):
Patent42 SA - 4081 Esch-sur-Alzette (Luxembourg)

47

Date de délivrance: 03/06/2022

73

Titulaire(s):
XINJIANG INSTITUTE OF ECOLOGY AND GEOGRAPHY,
CAS - Urumqi, Xinjiang (Chine)

54

Image Recognition Method and System for Natural Disasters in Power Transmission Corridor.

57 An image recognition method and system for natural disasters in power transmission corridors, which includes six steps: image data collection, image data processing, image data feature extraction, image collection processing, image data feature extraction and disaster type identification. By acquiring the image data of the selected power transmission corridor area, recording the location corresponding to the image data, scanning the image data, excluding normal image data, looking for abnormal image data, According to the location corresponding to the abnormal image data, the satellite remote sensing image of the location is obtained, that is, the accuracy of data identification is further improved by quoting the satellite remote sensing image data, so that the accuracy of natural disaster identification can be improved while replacing the traditional manual survey method, and the satellite remote sensing image is aimed at the abnormal data in the image data, and the data is obtained through pertinence.

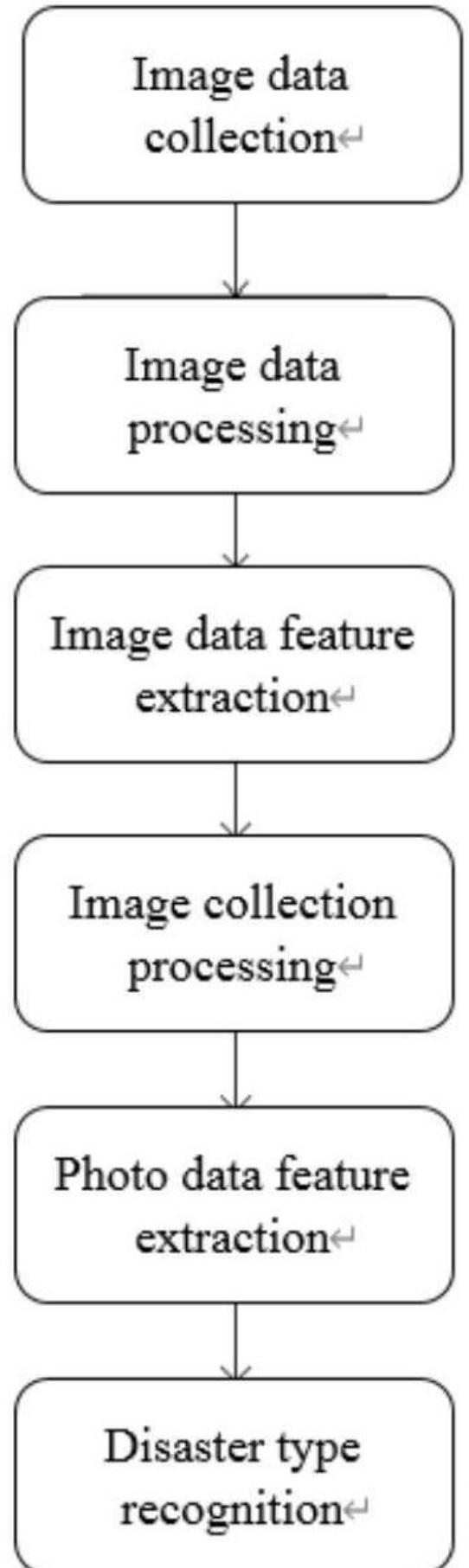


FIG. 1

DESCRIPTION**Image Recognition Method and System for Natural Disasters in Power
Transmission Corridor****TECHNICAL FIELD**

The invention relates to that technical field of image processing, in particular to a method and a system for identify images of natural disasters in power transmission corridor.

BACKGROUND

Transmission corridor, also known as transmission line corridor, refers to the belt-shaped area under the line with specified width extending to both sides along the roadside conductor of high-voltage overhead power line, in which the public is allowed to enter or engage in basic agriculture and other restricted production activities;

In recent years, the logistics and mechanical impacts of natural disasters on the power grid occur frequently, and the power system failures directly or indirectly caused by natural disasters are increasing year by year, which brings great trouble to the society, and then it is necessary to monitor natural disasters.

However, the traditional geological disaster monitoring mainly relies on manual field survey. However, because the transmission corridor involves a wide range, the field terrain is complex, and then a lot of manpower and material resources need to be invested, the cost is high, and the monitoring efficiency is low. Therefore, the invention proposes a method and system for identifying natural disaster images in the transmission corridor to solve the problems existing in the prior art.

SUMMARY

In view of the above problems, the purpose of the present invention is to propose an image recognition method and system for natural disasters in power transmission corridors. The image recognition method and system for natural disasters in power transmission corridors can identify natural disasters in power transmission corridors by combining image data of power transmission corridors with satellite remote sensing images, thus solving the problems in the prior art.

In order to realize the purpose of the invention, the invention is realized by the following technical scheme: a method and a system for identifying natural disaster images of power transmission corridors following by the steps.

Step 1, image data collection;

firstly, select the transmission corridor area to be identified, then collect images of the selected transmission corridor area to obtain image data, and record information according to the collected image data.

Step 2, image data processing;

denoising the first image data obtained in step one by using wavelet transform algorithm, and then scanning the first image data frame by frame, that is, converting to processing image data, excluding normal image data, finding abnormal image data, and recording to obtain recorded image data.

Step 3, feature extraction of image data;

splitting the image data recorded in step 3 frame by frame into multiple groups of photo data, then extracting disaster features from multiple groups of image data to obtain first disaster feature data, and obtaining information records corresponding to the currently processed image data.

Step 4, image acquisition and processing;

according to the information record corresponding to the currently processed image data in step 3, obtaining the satellite remote sensing image of the place corresponding to the information record, processing the satellite remote sensing image, and then using the wavelet transform algorithm to denoise the obtained remote sensing image data to obtain the denoised remote sensing image data.

Step 5, feature extraction of photo data;

extracting the remote sensing image data obtained in step 4 to obtain second disaster characteristic data.

Step 6, disaster type identification

analyzing the first disaster characteristic data obtained in step 3 and the second disaster characteristic data obtained in step 5, and identify the disaster type.

The further improvement is that in the step 1, the selected transmission corridor

area is collected by using the unmanned aerial vehicle cruise mode.

The further improvement is that in the step 1, the information recording includes recording the time and place corresponding to the image data.

The further improvement is that in the step 2, when the abnormal image data is not scanned, the recognition result is directly output.

The further improvement is that in the step 3, the obtain information corresponding to the currently process image data is the location corresponding to the currently processed image data.

The further improvement is that in the step 4, the processing methods of satellite remote sensing images include radiation correction and geometric correction.

The invention relates to an identification system of an image identification method for natural disasters in power transmission corridors, which comprises an image acquisition module, a photo acquisition module, a data processing module, a feature extraction module and an identification output module, wherein the output ends of the image acquisition module and the image acquisition module are both connected with the input end of the data processing module, the output end of the data processing module is connected with the input end of the feature extraction module, and the output end of the feature extraction module is connected with the identification output module.

The further improvement is that the system also includes a record storage module, which is connected with the feature extraction module and the image acquisition module.

The invention has the beneficial effects that the image recognition method and system for natural disasters in power transmission corridors acquire image data of selected power transmission corridor areas, record the locations corresponding to the image data, scan the image data, exclude normal image data, find abnormal image data, and acquire satellite remote sensing images of the locations corresponding to the abnormal image data, That is, the accuracy of data identification can be further improved by referencing satellite remote sensing image data, so that the accuracy of natural disaster identification can be improved while replacing the traditional manual

survey method, and the satellite remote sensing image is aimed at the abnormal data in the image data, and the data can be acquired through pertinence, which is conducive to improving the efficiency of overall identification.

BRIEF DESCRIPTION OF THE FIGURES

In order to more clearly explain the embodiments of the present invention or the technical solutions in the prior art, the following will briefly introduce the drawings that need to be used in the description of the embodiments or the prior art. Obviously, the drawings in the following description are only some embodiments of the present invention, and for ordinary technicians in the field, other drawings can be obtained according to these drawings without paying any creative effort.

FIG. 1 is a schematic diagram of the steps of the first embodiment of the present invention.

FIG. 2 is a schematic diagram of the system flow of the second embodiment of the present invention.

DESCRIPTION OF THE INVENTION

The technical solutions in the embodiments of the present invention will be clearly and completely described with reference to the drawings in the embodiments of the present invention. Obviously, the described embodiments are only part of the embodiments of the present invention, not all of them. Based on the embodiments in the present invention, all other embodiments obtained by ordinary technicians in the field without creative work are within the scope of the present invention.

In the description of the present invention, it should be noted that unless otherwise specified and limited, the term "connection" should be broadly understood, for example, it can be fixed connection, detachable connection or integrated connection, can be mechanically connected or electrically connected, can be directly connected, can also be indirectly connected through an intermediate medium, and can be the internal communication of two elements. For ordinary technicians in the field, the specific meanings of the above terms in the present invention can be understood in specific situations.

Example 1

As shown in FIG. 1, this embodiment proposes a method for image recognition of natural disasters in power transmission corridors, which includes the following steps:

Step 1, image data collection;

firstly, select the transmission corridor area to be identified, then collect images of the selected transmission corridor area to obtain image data, and record information according to the collected image data. In step one, collect images of the selected transmission corridor area by using unmanned aerial vehicle cruising. In step one, record information includes recording the time and place corresponding to the image data;

Step 2, image data processing;

denoising the first image data obtained in step one by using wavelet transform algorithm, and then scanning the first image data frame by frame, that is, converting to processing image data, excluding normal image data, finding abnormal image data, and recording to obtain recorded image data;

Step 3, feature extraction of image data;

splitting the image data recorded in step 3 frame by frame into multiple groups of photo data, extracting disaster characteristics from multiple groups of image data to obtain first disaster characteristic data, and obtaining information records corresponding to the currently processed image data, combining the first disaster characteristic data obtained in step 3 with the second disaster characteristic data obtained in step 5, and identifying the disaster type; step 3, obtaining the information corresponding to the currently processed image data as the location corresponding to the currently processed image data;

Step 4, image acquisition and processing;

according to the information record corresponding to the currently processed image data in step 3, obtaining the satellite remote sensing image of the place corresponding to the information record, processing the satellite remote sensing image, and then using the wavelet transform algorithm to denoise the obtained remote sensing image data to obtain the denoised remote sensing image data. In step 4, the

processing methods of the satellite remote sensing image include radiation correction and geometric correction;

Step 5, feature extraction of photo data;

extracting the remote sensing image data obtained in step 4 to obtain second disaster characteristic data;

Step 6, disaster type identification;

combine the first disaster feature data obtained in step 3 with the second disaster feature data obtained in step 5, and identify the disaster type. In this process, the neural convolution network is used to identify, and then the disaster type is determined by the first disaster feature data and the second disaster feature data.

Example 2

As shown in FIG. 2, this embodiment proposes an image recognition system for natural disasters in power transmission corridors, which includes an image acquisition module, an image acquisition module, a data processing module, a feature extraction module and an identification output module. The output ends of the image acquisition module and the image acquisition module are connected with the input end of the data processing module, the output end of the data processing module is connected with the input end of the feature extraction module, and the output end of the feature extraction module is connected with the identification output module.

It also includes a record storage module, which is connected with the feature extraction module and the image acquisition module, and mainly records information.

In this embodiment, a control interface module is also included, which is mainly used to facilitate the staff to connect with the system through mobile devices and computer devices.

In this embodiment, the image acquisition module uses unmanned aerial vehicle (UAV) for cruising, in which the UAV is equipped with camera and GPS positioning. According to the pictures taken by the camera and positioning information of GPS positioning, the image data can correspond to a GPS positioning point, which is convenient for location confirmation of abnormal data. At the same time, the UAV transmits data through wireless communication technology, and the image acquisition

module is connected with external websites through wireless communication technology to obtain satellite remote sensing images from public websites.

Example 3

In this embodiment, under the condition of processing abnormal image data, a method for identifying natural disaster images in power transmission corridors is proposed, which includes the following steps:

Step 1, image data collection

Firstly, select the transmission corridor area to be identified, then collect images of the selected transmission corridor area to obtain image data, and record information according to the collected image data. In step one, collect images of the selected transmission corridor area by using unmanned aerial vehicle cruising. In step one, record information includes recording the time and place corresponding to the image data;

Step 2, image data processing

Denoise the first image data obtained in the step 1 by using wavelet transform algorithm, and then scan the first image data frame by frame, that is, convert it to image data processing, exclude normal image data, find abnormal image data, and record to obtain recorded image data. If no abnormal image data is found after scanning the first image data, the output result is normal directly;

That is, in this embodiment, the transmission corridor regularly acquires image data, and each time, it is judged whether there is any abnormal situation according to the acquired image data. If there is no abnormal situation, subsequent steps are not needed, and the result is directly output.

Example 4

Step 1, image data collection

Firstly, the power transmission corridor area to be identified is selected, and then the selected power transmission corridor area is subjected to image collection to obtain image data, and information recording is carried out according to the collected image data, and the selected power transmission corridor area is subjected to image collection by means of unmanned aerial vehicle cruising, and the information

recording includes recording the time and place corresponding to the image data. In this embodiment, the selected power transmission corridor area is divided into a plurality of sub-areas, And the image data of multiple sub-regions can be obtained by drone cruising, so that batch identification can be carried out according to the obtained sub-region image data; meanwhile, in the process of identification, the image data of the next sub-region can be continuously obtained by drone cruising, that is, all the image data in the selected transmission corridor area can be obtained and processed in batches, which is beneficial to improving work efficiency and reducing the image data to be processed once;

Step 2, image data processing

The first image data obtained in step 1 is denoised by wavelet transform algorithm, and then scanned frame by frame, that is, converted to image data processing, excluding normal image data, finding abnormal image data, and recording to obtain recorded image data, that is, scanning and identifying the image data in multiple sub-areas, discharging the normal image data, finding out abnormal data, In the step 1, the whole power transmission corridor area is divided into a plurality of sub-areas, and then in the process of single processing, manual intervention is performed, and the image data is watched manually, so that abnormal data or normal data is determined, and when abnormal data is found, it is recorded;

Step 3, feature extraction of image data

Split the image data recorded in step 3 frame by frame into multiple groups of photo data, that is, split the image data of sub-areas, and extract disaster features from multiple groups of image data to obtain first disaster feature data. The disaster features extracted from multiple groups of image data usually occur in the same area, then the accuracy of the first disaster feature data can be improved through multiple image data, and the information records corresponding to the currently processed image data can be obtained. Combining the first disaster feature data obtained in step 3 with the second disaster feature data obtained in step 5, identifying the disaster type, and obtaining the information corresponding to the currently processed image data as the location corresponding to the currently processed image data;

Step 4, image acquisition and processing

According to the information record corresponding to the currently processed image data in step 3, obtaining the satellite remote sensing image of the place corresponding to the information record, processing the satellite remote sensing image, and then using the wavelet transform algorithm to denoise the obtained remote sensing image data to obtain the denoised remote sensing image data, wherein the processing methods of the satellite remote sensing image include radiation correction and geometric correction;

Step 5, feature extraction of photo data.

Extracting the remote sensing image data obtained in step 4 to obtain second disaster characteristic data;

Step 6, disaster type identification

Combine the first disaster feature data obtained in step 3 with the second disaster feature data obtained in step 5, and identify the disaster type. In this process, the neural convolution network is used to identify, and then the disaster type is determined by the first disaster feature data and the second disaster feature data.

According to the invention, the image data of the selected power transmission corridor area is acquired, the location corresponding to the image data is recorded, then the image data is scanned, normal image data is excluded, abnormal image data is searched, and the satellite remote sensing image of the location is acquired according to the location corresponding to the abnormal image data, that is, the accuracy of data identification is further improved by quoting the satellite remote sensing image data, so that while replacing the traditional manual survey mode, The accuracy of natural disaster identification can be improved, and satellite remote sensing images are aimed at abnormal data in image data, and data can be acquired through pertinence, which is conducive to improving the efficiency of overall identification.

The basic principle, main features and advantages of the present invention have been described above. Those skilled in the industry should know that the present invention is not limited by the above-mentioned embodiments. What is described in

the above-mentioned embodiments and descriptions only illustrate the principles of the present invention. Without departing from the spirit and scope of the present invention, there will be various changes and improvements of the present invention, which all fall within the scope of the claimed invention. The scope of protection claim by that present invention is defined by the append claims and their equivalents.

CLAIMS

1. A method for identifying natural disaster images of power transmission corridors is characterized by comprising the following steps:

step 1, image data collection;

firstly, select the transmission corridor area to be identified, then collect images of the selected transmission corridor area to obtain image data, and record information according to the collected image data;

step 2, image data processing;

denoising the first image data obtained in step one by using wavelet transform algorithm, and then scanning the first image data frame by frame, that is, converting to processing image data, excluding normal image data, finding abnormal image data, and recording to obtain recorded image data;

step 3, feature extraction of image data;

splitting the image data recorded in step 3 frame by frame into multiple groups of photo data, then extracting disaster features from multiple groups of image data to obtain first disaster feature data, and obtaining information records corresponding to the currently processed image data;

step 4, image acquisition and processing;

according to the information record corresponding to the currently processed image data in step 3, obtaining the satellite remote sensing image of the place corresponding to the information record, processing the satellite remote sensing image, and then using the wavelet transform algorithm to denoise the obtained remote sensing image data to obtain the denoised remote sensing image data;

step 5, feature extraction of photo data;

extracting the remote sensing image data obtained in step 4 to obtain second disaster characteristic data;

step 6, disaster type identification

analyzing the first disaster characteristic data obtained in step 3 and the second disaster characteristic data obtained in step 5, and identify the disaster type.

2. The method for identifying natural disaster images of power transmission

corridors according to claim 1 is characterized in that in the step 1, the selected transmission corridor area is collected by using the unmanned aerial vehicle cruise mode.

3. The method for identifying natural disaster images of power transmission corridors according to claim 1 is characterized in that in the step 1, the information recording includes recording the time and place corresponding to the image data.

4. The method for identifying natural disaster images of power transmission corridors according to claim 1 is characterized in that in the in the step 2, when the abnormal image data is not scanned, the recognition result is directly output.

5. The method for identifying natural disaster images of power transmission corridors according to claim 1 is characterized in that in the step 3, the obtain information corresponding to the currently process image data is the location corresponding to the currently processed image data.

6. The method for identifying natural disaster images of power transmission corridors according to claim 1 is characterized in that in the step 4, the processing methods of satellite remote sensing images include radiation correction and geometric correction.

7. An system of the method for identifying natural disaster images of power transmission corridors according to claim 1 is characterized by comprising an image acquisition module, an image acquisition module, a data processing module, a feature extraction module and an identification output module, wherein the output ends of the image acquisition module and the image acquisition module are both connected with the input end of the data processing module, the output end of the data processing module is connected with the input end of the feature extraction module, and the output end of the feature extraction module is connected with the identification output module.

8. The system of the method for identifying natural disaster images of power transmission corridors according to claim 7 is characterized by also comprising a record storage module, which is connected with the feature extraction module and the image acquisition module.

PATENTANSPRÜCHE

1. Ein Verfahren zur Identifizierung von Naturkatastrophen in Stromübertragungskorridoren durch Bildern ist dadurch gekennzeichnet, dass es die folgenden Schritte umfasst:

Schritt 1, Sammlung von Bilddaten;

Zunächst wird eine zu identifizierende Stromübertragungskorridore ausgewählt, dann werden Bilder des ausgewählten Stromübertragungskorridores gesammelt, um Bilddaten zu erhalten, Informationen über die gesammelten Bilddaten werden aufgezeichnet;

Schritt 2, Verarbeitung der Bilddaten;

Rauschunterdrückung der in Schritt 1 erhaltenen ersten Bilddaten unter Verwendung eines Wavelet-Transformationsalgorithmus und anschließende Bildabtastung der ersten Bilddaten, d.h., Verarbeitung von Bilddaten, Ausschluss normaler Bilddaten, Auffinden abnormaler Bilddaten und Aufzeichnung, um aufgezeichnete Bilddaten zu erhalten;

Schritt 3, Merkmalsextraktion von Bilddaten;

Aufteilung der in Schritt 3 aufgezeichneten Bilddaten Bild für Bild in mehrere Gruppen von Fotodaten, dann Extrahieren von Merkmalen der Katastrophen aus mehreren Gruppen von Bilddaten, um erste Merkmalsdaten der Katastrophen zu erhalten, und Erhalten von Informationsdatensätzen, die den aktuell verarbeiteten Bilddaten entsprechen;

Schritt 4, Bilderfassung und -verarbeitung;

entsprechend dem Informationsdatensatz, der den aktuell verarbeiteten Bilddaten in Schritt 3 entspricht, Gewinnung des Satelliten-Fernerkundungsbildes des Ortes, der dem Informationsdatensatz entspricht, Verarbeitung des Satelliten-Fernerkundungsbildes und anschließende Verwendung des Wavelet-Transformationsalgorithmus zur Rauschunterdrückung der erhaltenen Fernerkundungsbilddaten, um die entrauschten Fernerkundungsbilddaten zu erhalten;

Schritt 5, Merkmalsextraktion von Fotodaten;

Extraktion der in Schritt 4 erhaltenen Fernerkundungsbilddaten, um zweite Merkmalsdaten der Katastrophen zu erhalten;

Schritt 6, Identifizierung des Katastrophentyps

Analyse der in Schritt 3 erhaltenen ersten Katastrophenmerkmalsdaten und der in Schritt 5 erhaltenen zweiten Katastrophenmerkmalsdaten und Identifizierung des Katastrophentyps.

2. Das Verfahren zur Identifizierung von Naturkatastrophen in Stromübertragungskorridoren durch Bildern nach Anspruch 1 ist dadurch gekennzeichnet, dass in Schritt 1 die Bilder des ausgewählte Stromübertragungskorridores durch den Reiseflug von unbemannten Luftfahrzeugs erfasst wird.

3. Das Verfahren zur Identifizierung von Naturkatastrophen in Stromübertragungskorridoren durch Bildern nach Anspruch 1 ist dadurch gekennzeichnet, dass in Schritt 1 die aufgezeichneten Informationen die Zeit und den Ort umfasst, die Bilddaten umfassen.

4. Das Verfahren zur Identifizierung von Naturkatastrophen in Stromübertragungskorridoren durch Bildern nach Anspruch 1 ist dadurch gekennzeichnet, wenn die anormalen Bilddaten in Schritt 2 nicht gescannt werden, wird das Erkennungsergebnis direkt ausgegeben.

5. Das Verfahren zur Identifizierung von Naturkatastrophen in Stromübertragungskorridoren durch Bildern nach Anspruch 1 ist dadurch gekennzeichnet, dass in Schritt 3 die erhaltene Information der aktuell verarbeiteten Bilddaten der Ort der aktuell verarbeiteten Bilddaten ist.

6. Das Verfahren zur Identifizierung von Naturkatastrophen in Stromübertragungskorridoren durch Bildern nach Anspruch 1 ist dadurch gekennzeichnet, dass in Schritt 4 die Verarbeitungsmethoden von Satelliten-Fernerkundungsbildern Strahlungskorrektur und eine geometrische Korrektur umfassen.

7. Ein System gemäß dem Verfahren zur Identifizierung von Naturkatastrophen in Stromübertragungskorridoren durch Bildern gemäß Anspruch 1 ist dadurch

gekennzeichnet, dass es ein Abbilderfassungsmodul, ein Bilderfassungsmodul, ein Datenverarbeitungsmodul, ein Merkmalsextraktionsmodul und ein Identifizierungsausgabemodul umfasst, wobei die Ausgangsenden des Abbilderfassungsmoduls und des Bilderfassungsmoduls beide mit dem Eingangsende des Datenverarbeitungsmoduls verbunden sind, und das Ausgangsende des Datenverarbeitungsmoduls mit dem Eingangsende des Merkmalsextraktionsmoduls verbunden ist, und der Ausgang des Moduls zur Merkmalsextraktion mit dem Identifikationsausgabemodul verbunden ist.

8. Das System gemäß dem Verfahren zur Identifizierung von Naturkatastrophen in Stromübertragungskorridoren durch Bildern nach Anspruch 7 ist dadurch gekennzeichnet, dass es auch ein Datenspeichermodul umfasst, das mit dem Merkmalsextraktionsmodul und dem Bilderfassungsmodul verbunden ist.

FIGURES

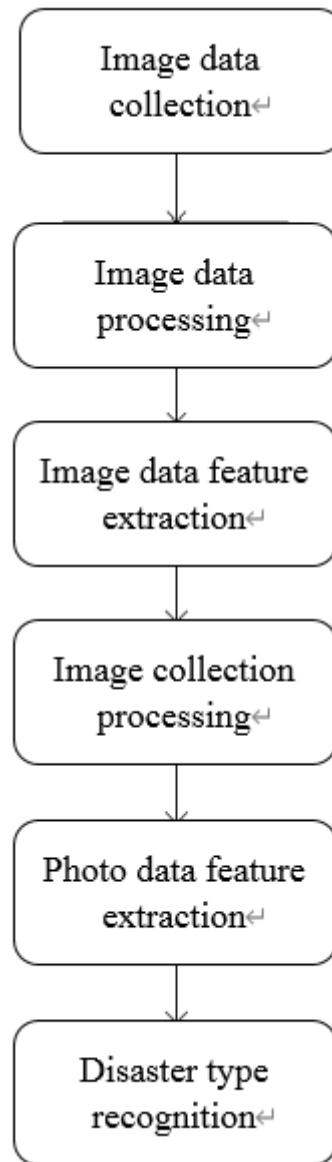


FIG. 1

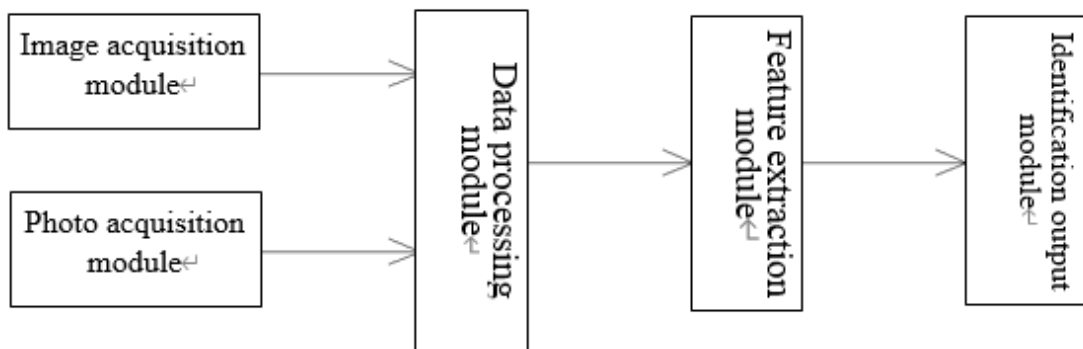


FIG. 2