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(71)出願人　000005201
富士写真フイルム株式会社
神奈川県南足柄市中沼210番地
(72)発明者　宝岡　孝
神奈川県南足柄市中沼210番地　富士写真フイルム株式会社内
(74)代理人　100080159
弁理士　渡辺　望稔　（外２名）

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(54)【発明の名称】　マルチバンドカメラ用フィルターとその形成方法並びにこの方法のプログラム及びこれを記録した記録媒体

(57)【要約】
【課題】近接する波長に対応するスペクトル画像の値のつながりを悪化させないようにした、マルチバンドカメラ用フィルターとその形成方法並びにこの方法のプログラム及びこれを記録した記録媒体を提供すること。
【解決手段】少なくとも６色種以上の色フィルター要素を配列したことを特徴とするマルチバンドカメラ用フィルターであって、前記色フィルター要素の配列の順序を、マルチバンドの色フィルター要素の中心波長の順としたことを特徴とするマルチバンドカメラ用フィルター。前記色フィルター要素を、前記マルチバンドの色フィルター要素の中心波長の順に配列する際には、前記色フィルター要素を、平面上で渦巻き状に配列することが好ましい。

	1	2	3	4	5	6	7	8	9
a	650	630	610	590	610	630	650	630	610
b	670	450	430	570	430	450	670	450	430
c	690	470	410	550	410	470	690	470	410
d	710	490	510	530	510	490	710	490	510
e	690	470	410	550	410	470	690	470	410
f	670	450	430	570	430	450	670	450	430
g	650	630	610	590	610	630	650	630	610
h	670	450	430	570	430	450	670	450	430
i	690	470	410	550	410	470	690	470	410

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【００１２】また、上記コンピュータプログラムは、これをコンピュータにより読み出し可能な記録媒体に記録して流通させることが可能であり、本発明の権利範囲は、このような記録媒体にも及ぶものである。

【００１３】なお、本明細書中において、色フィルター要素とは、マルチバンドカメラ用のフィルターを構成する、各透過波長域に対応する個々の色フィルターを指すものとする。

【００１４】

【発明の実施の形態】以下、添付の図面に基づいて、本発明の実施の形態を詳細に説明する。以下の説明においては、１６チャンネルのマルチバンドカメラ用のフィルターとその形成方法を例に挙げて説明する。

【００１５】図３は、可視域光を１６の領域に分割した場合を示すもので、ここでは、４１０ｎｍ，４３０ｎｍ，４５０ｎｍ，４７０ｎｍ，４９０ｎｍ，５３０ｎｍ，５５０ｎｍ，５７０ｎｍ，５９０ｎｍ，６１０ｎｍ，６３０ｎｍ，６５０ｎｍ，６７０ｎｍ，６９０ｎｍ，７１０ｎｍに透過極大を有する色フィルター要素を用いる例を示している。

【００１６】上述の１６色の色フィルター要素を、モノクロ単板ＣＣＤセンサー上に配列する際には、図１に示すような配列を単位配列とする。

【００１７】図１に示す配列は、左上角から右へ１こま，下へ１こま行った点をスタート点（４１０ｎｍ）として、ここから左回りに渦巻き状に４１０ｎｍ→４３０ｎｍ→４５０ｎｍ→４７０ｎｍ→４９０ｎｍ→５３０ｎｍ→５５０ｎｍ→５７０ｎｍ→５９０ｎｍ→６１０ｎｍ→６３０ｎｍ→６５０ｎｍ→６７０ｎｍ→６９０ｎｍ→７１０ｎｍと配列され、右上角が終点（７１０ｎｍ）となっている。

【００１８】図２は、具体的な１６チャンネルのマルチバンドカメラ用のフィルターの構成の一部を示すものであり、基本的には、図１に示した単位配列を、その外郭を、一方を反転させた状態で重ね合わせた構成となっている。

【００１９】以下、説明を判りやすくするために、図２に示した１６チャンネルのマルチバンドカメラ用のフィルター中の各色フィルター要素の配列に、行番号（縦：１，２，……）及び列番号（横：ａ，ｂ，……）をつけて説明する。

【００２０】例えば、位置５ｅ（つまり、左上角から見て、右へ４こま，下へ４こま行った点）をスタート点とする単位配列（これを、単位配列Ａという）を基準に考えると、この単位配列Ａの左隣りには、単位配列Ａを左右反転させた単位配列が、また、単位配列Ａの上隣りには、単位配列Ａを上下反転させた単位配列が、いずれも１行（または、１列）重なった状態で、連続的に配列されている。

【００２１】すなわち、本実施形態によれば、上述の単位配列Ａを順次、左右反転または上下反転させた状態で、次々に連続的に配列することが可能である。

【００２２】このような形で単位配列Ａを順次連続的に配列することができるため、本実施形態によれば、次のような効果が得られる。

【００２３】連続する色フィルターにより取得された画素が、隣り合って配列されることになるので、上下・左右で色の偏りがなくなって、均等にばらつくという利点がある。また、画素が隣り合うことで、スペクトルのつながりがよくなるというメリットもある。

【００２４】換言すれば、画素が隣り合ってはいても、渦巻き状に配列（単位配列内）されることに起因して、色の偏りがなく（虹のようにならない）、平均化されたスペクトルが得られるという利点がある。

【００２５】上記実施形態によれば、１６チャンネルのマルチバンドカメラ用のフィルターとして、色の偏りがなく、スペクトルのつながりがよくなる構成を提供することができる。

【００２６】なお、上記実施形態は本発明の一例を示したものであり、本発明はこれに限定されるべきものではなく、本発明の要旨を変更しない範囲内で、適宜の変更，改良などを行ってもよいことはいうまでもない。

【００２７】例えば、上記実施形態においては、単位配列Ａを左右反転または上下反転させるとともに、隣り合った単位配列間で、最外郭の１行（または、１列）を重ね合わせるようにしたが、この重ね合わせはなくてもよく、また、逆に、２行（または、２列）以上としてもよい。

【００２８】また、本発明に係るマルチバンドカメラ用フィルターの形成方法は、コンピュータに種々のパラメータをセットして、上述の色フィルターの配列のルールを記憶させて、それに基づいて、予め用意された色フィルター要素を配列させることで、容易に所望の色フィルター配列を有するマルチバンドカメラ用フィルターを形成することが可能である。

【００２９】本発明に係るマルチバンドカメラ用フィルターの形成方法は、これをコンピュータ制御により実行することが可能であり、本発明は、このためのコンピュータプログラムをも含むものである。

【００３０】また、上記コンピュータプログラムは、これをコンピュータにより読み出し可能な記録媒体に記録して流通させることが可能であり、本発明の権利範囲は、このような記録媒体にも及ぶものである。

【００３１】

【発明の効果】以上、詳細に説明したように、本発明によれば、近接する波長に対応するスペクトル画像の値のつながりを悪化させないようにしたマルチバンドカメラ用フィルターとその形成方法を実現できるという顕著な効果を奏するものである。

【００３２】また、前述のように、上記の方法を、プロ

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CLAIMS

[Claim(s)]
[Claim 1] The filter for multi-band cameras characterized by arranging the color filter element of at least six or more color types.
[Claim 2] The filter for multi-band cameras according to claim 1 characterized by making sequence of the array of said color filter element into the order of the main wavelength of the color filter element of a multi-band.
[Claim 3] The filter for multi-band cameras according to claim 2 characterized by arranging said color filter element to a curled form on a flat surface in case said color filter element is arranged in order of the main wavelength of the color filter element of said multi-band.
[Claim 4] The filter for multi-band cameras characterized by combining and becoming about this array unit so that that outline channel may overlap the outline channel of other array units by making into an array unit the color filter element group arranged by said curled form according to claim 3.
[Claim 5] The formation approach of the filter for multi-band cameras which arranges said each element of the filter for multi-band cameras which arranged the color filter element of at least six or more color types to a curled form on a flat surface, and makes it an array unit in order of the main wavelength of the color filter element of a multi-band, and is characterized by combining this array unit so that that outline channel may overlap the outline channel of other array units.
[Claim 6] The computer program for performing the formation approach of the filter for multi-band cameras according to claim 5 by computer control.
[Claim 7] The record medium which recorded the computer program according to claim 6 and in which read-out [computer] is possible.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the filter for multi-band cameras it was made not to worsen relation of the value of the filter for multi-band cameras and the spectrum image corresponding to the wavelength which more specifically approaches that formation approach list about the record medium which recorded the program of this approach and this, and the record medium which recorded the program of this approach, and this on that formation approach list.
[0002]
[Description of the Prior Art] In a color veneer CCD camera, the color filter of three or more channels has been arranged in the monochrome veneer CCD sensor, and the image of three or more channels is acquired from the former. As a configuration method of a color filter in this case, the Bayer array is used in many cases.

[0003]
[Problem(s) to be Solved by the Invention] However, as a multi-band camera, in order to acquire the spectrum image of six or more channels, it is necessary to combine a monochrome veneer CCD sensor (camera) and the color filter of six channels.
[0004] The array approach of the color filter array proposed from the former is limited only to three channels, is not devised, and cannot be adopted as an array as an object for the multi-band cameras of six or more channels.
[0005] Moreover, on wavelength, although how to arrange in vertical 1 train and width 1 train simply is also considered, in order that distance may separate [two channels which should adjoin each other] on a CCD sensor, there is a problem that relation of a spectrum will get worse, by the relation which a clinch surely generates.
[0006] This invention was made in view of the above-mentioned situation, and the place made into that purpose has it in offering the filter for multi-band cameras solve [filter] the problem in a Prior art and it was made not to worsen relation of the value of the spectrum image corresponding to the approaching wavelength, and the record medium which recorded the program of this approach, and this on that formation approach list.
[0007]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, the filter for multi-band cameras concerning this invention is a filter for multi-band cameras characterized by arranging the color filter element of at least six or more color types, and is characterized by making sequence of the array of said color filter element into the order of the main wavelength of the color filter element of a multi-band.
[0008] In the filter for multi-band cameras concerning this invention, in case said color filter element is arranged in order of the main wavelength of the color filter element of said multi-band, it is desirable to arrange said color filter element to a curled form on a flat surface.
[0009] Furthermore, in the filter for multi-band cameras concerning this invention, it is desirable to combine and to constitute this array unit by making into an array unit the color filter element group arranged by the above-mentioned curled form, so that that outline channel may overlap the outline channel of other array units.

[0010] Moreover, in order of the main wavelength of the color filter element of a multi-band, said each element of the filter for multi-band cameras which arranged the color filter element of at least six or more color types is arranged to a curled form on a flat surface, and the formation approach of the filter for multi-band cameras concerning this invention makes it an array unit, and is characterized by combining this array unit so that that outline channel may overlap the outline channel of other array units.
[0011] The formation approach of the filter for multi-band cameras concerning this invention can perform this by computer control, and this invention also contains the computer program for it.
[0012] Moreover, this is recorded on the record medium which can be read by computer, the above-mentioned computer program can circulate it, and the right range of this invention also attains to such a record medium.
[0013] In addition, a color filter element shall point out each color filter corresponding to each transmitted wave length region which constitutes the filter for multi-band cameras into this specification.
[0014]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to a detail based on an attached drawing. In the following explanation, the filter and its formation approach for multi-band cameras of 16 channels are mentioned as an example, and are explained.
[0015] Drawing 3 shows the case where visible region light is divided into the field of 16, and shows the example using the color filter element which has the transmission maximum in 410nm, 430nm, 450nm, 470nm, 490nm, 530nm, 550nm, 570nm, 590nm, 610nm, 630nm, 650nm, 670nm, 690nm and 710nm here
[0016] An array in case the color filter element of 16 above-mentioned colors is arranged on a monochrome veneer CCD sensor, as shows it to drawing 1 is considered as a unit array.
[0017] It turns 1 top ******** a starting point (410nm) down, turning as 1 top the array shown in drawing 1 from the upper left hand corner to the right, it be arranged by the curled form in the counterclockwise direction from here with 410nm -> 430nm -> 450nm -> 470nm -> 490nm -> 530nm -> 550nm -> 570nm -> 590nm -> 610nm -> 630nm -> 650nm -> 670nm -> 690nm -> 710nm, and the upper right corner serves as a terminal point (710nm).
[0018] Drawing 2 shows a part of configuration of the concrete filter for multi-band cameras of 16 channels, and, fundamentally, has [outline / the] the composition of having piled up one side in the condition of having made it reversed, in the unit array shown in drawing 1 .
[0019] Hereafter, in order to give explanation intelligible, a line number (length: 1, 2, ...) and a row number (width: a, b, ..) are given and explained to the array of each color filter element in the filter for multi-band cameras of 16 channels shown in drawing 2 .
[0020] For example, if it thinks on the basis of the unit array (this is called unit array A) which makes a starting point location 5e (that is, seeing from the upper left hand corner right 4 tops and under 4 top ********) On the left of this unit array A, each unit array to which the unit array which carried out right-and-left reversal of the unit array A made the vertical reversal of the unit array A carry out next to [of the unit array A] the upper again is continuously arranged, after one line (or one train) has lapped.
[0021] That is, according to this operation gestalt, it is in the condition of it having been right-and-left-reversed, or vertical reversing the above-mentioned unit array A one by one, and arranging continuously one after another is possible.
[0022] Since the unit array A can be continuously arranged one by one in such a form, according to this operation gestalt, the following effectiveness is acquired.
[0023] Since the pixel acquired with the continuous color filter will adjoin each other and will be arranged, there is an advantage of the bias of a color being lost and differing in the upper and lower sides and right and left equally. Moreover, there is also a merit that relation of a spectrum becomes good because a pixel adjoins each other.
[0024] If it puts in another way, even if the pixel adjoins each other, it originates in being arranged by the curled form (inside of a unit array), and there is an advantage that there is no bias of a color (it does not become like a rainbow), and the equalized spectrum is obtained.
[0025] According to the above-mentioned operation gestalt, the configuration to which there is no bias of a color and relation of a spectrum becomes good as a filter for multi-band cameras of 16 channels can be offered.
[0026] In addition, it cannot be overemphasized that proper modification, amelioration, etc. may be performed within limits which the above-mentioned operation gestalt shows an example of this invention, and this invention should not be limited to this, and do not change the summary of this invention.
[0027] For example, in the above-mentioned operation gestalt, although one line (or one train) of the maximum outline was piled up between the adjacent unit arrays while it was right-and-left-reversed or vertical reversing the unit array A, this superposition may not exist and is good also as more than two line (or two trains) conversely.
[0028] Moreover, the formation approach of the filter for multi-band cameras concerning this invention is making the color filter element which set various parameters to the computer, was made to memorize the Ruhr of the array of an above-mentioned color filter, and was beforehand prepared based on it arrange, and can form the filter for multi-band cameras which has a desired color filter array easily.
[0029] The formation approach of the filter for multi-band cameras concerning this invention can perform this by computer control, and this invention also contains the computer program for it.
[0030] Moreover, this is recorded on the record medium which can be read by computer, the above-mentioned computer program can circulate it, and the right range of this invention also attains to such a record medium.
[0031]
[Effect of the Invention] As mentioned above, as explained to the detail, according to this invention, the remarkable effectiveness that the filter for multi-band cameras it was made not to worsen relation of the value of the spectrum image corresponding to the approaching wavelength, and its formation approach are realizable is done so.
[0032] Moreover, it is also possible to commercialize the above-mentioned approach as mentioned above as a record medium which recorded a program or it.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing showing the example of a basic array (unit array) of the color filter combined with the CCD sensor of the 16-channel multi-band camera concerning 1 operation gestalt of this invention.
[Drawing 2] It is drawing showing the situation which combines the unit array shown in drawing 1 .
[Drawing 3] It is drawing showing typically the sensitivity profile of the color filter of a 16-channel multi-band camera.
[Description of Notations]
A Unit array

[Translation done.]

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DRAWINGS

[Drawing 1]

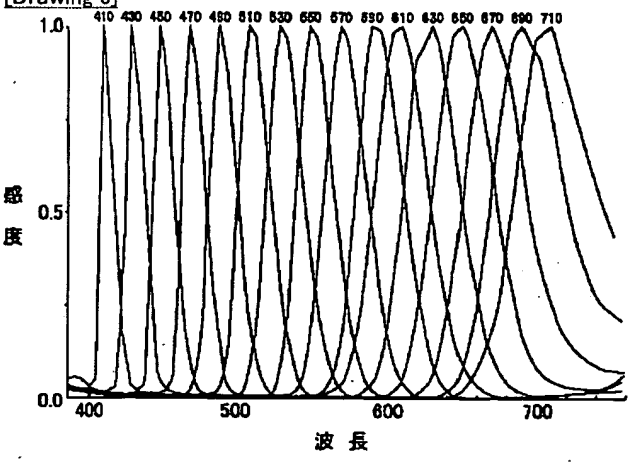
530	510	490	710
550	410	470	690
570	430	450	670
590	610	630	650

[Drawing 2]

	1	2	3	4	5	6	7	8	9
a	850	630	610	590	610	630	850	630	610
b	870	450	430	570	430	450	670	450	430
c	690	470	410	550	410	470	690	470	410
d	710	490	510	530	510	490	710	490	510
e	690	470	410	550	410	470	690	470	410
f	670	450	430	570	430	450	670	450	430
g	650	630	610	590	610	630	650	630	610
h	670	450	430	570	430	450	670	450	430
i	690	470	410	550	410	470	690	470	410

A

[Drawing 3]



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