**Method for Determining Clothing Sizes of Persons from Digital Pictures**

*Abstract*: Method for determining clothing sizes of persons from digital pictures, comprising the following steps in a suitable order: a) taking a frontal digital picture of at least the upper body part of said person while the arms of said person are spread in oblique lateral downward directions, said picture having an upper edge closest to the head of the person and a lower edge farthest from the head of the person; b) defining a horizontal line in said picture which is statistically almost certainly located well below the persons armpits; c) determining on both sides of the vertical centre line of the picture the distances, for instance in pixels, between the pixel of a horizontal line and the first contrasting pixel above said line which has a pre-determined significant different colour and/or brightness than the colour and/or brightness of the pixels below it; d) determining on each side of the vertical centre line an uppermost contrasting pixel having a local maximum determined distance from said horizontal line; e) determining the distance, for instance in pixels, between said two uppermost contrasting pixels; f) using said distance between said two uppermost contrasting pixels for calculating a clothing size of said person.

*Title*: METHOD FOR DETERMINING CLOTHING SIZES OF PERSONS FROM DIGITAL PICTURES

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Method for determining clothing sizes of persons from digital pictures

The invention relates to a method for determining clothing sizes of persons from digital pictures. Several such methods already exist, which are for instance used when ordering clothes on the internet. Typically the person ordering the clothes has at least one picture taken (usually two, one frontal and one lateral picture) in his own environment such as home, and sends these pictures together with a reference data such as his length and his order details to the internet shop selling the clothes. However, it appears to be difficult to provide a computer implemented method which automatically determines the correct clothing size of a person form these digital pictures. In particular it appears to be difficult to determine an accurate chest circumference.

The invention aims at providing a method which is better able to determine an accurate chest circumference.

According to the invention, the method comprises the following steps in a suitable order:

a) taking a frontal digital picture of at least the upper body part of said person while the arms of said person are spread in oblique lateral downward directions, said picture having an upper edge closest to the head of the person and a lower edge farthest from the head of the person;

b) defining a horizontal line in said picture which is statistically almost certainly located well below the persons armpits;
c) determining on both sides of the vertical centre line of the picture the distances, for instance in pixels, between the pixel of a horizontal line and the first contrasting pixel above said line which has a predetermined significant different colour and/or brightness than the colour and/or brightness of the pixels below it;

d) determining on each side of the vertical centre line an uppermost contrasting pixel having a local maximum determined distance from said horizontal line;

e) determining the distance, for instance in pixels, between said two uppermost contrasting pixels;

f) using said distance between said two uppermost contrasting pixels for calculating a clothing size of said person.

Preferably the method further comprises between step a) and step c), the step of digitally processing said picture such that a contour line of said person is determined. Such processes are well known as such. Preferably the method further comprises the step of filling the interior of said contour line with a monochrome colour. Preferably the method further comprises the step of filling the exterior of said contour line with a different monochrome colour. In this manner, the most accurate high contrast picture can be obtained for use in steps d and e.

Preferably the method further comprises the step of determining the length, for instance in pixels, of said person in said picture, and using the real length, for instance in mm, of the person to convert the distance, for instance in pixels, between said armpits in said picture into an actual distance, for instance in mm, between the armpits of said person. Preferably said method further
comprises the step of detecting the face of said person, and using said face recognition data to determine the length of the person. By using face recognition the height of a person's hair dress can be ignored. Said method further preferably comprises the step of using said face recognition data to determine the interior side of said contour.

Said method further preferably comprises the step of taking a lateral digital picture of at least the upper body part of said person and determining the chest depth, for instance in pixels, and using the chest depth in combination with the distance, for instance in pixels, determined in step e for calculating a clothing size of said person in step f.

Preferably in step a mobile computer programme is used, which is arranged to be loaded on a mobile computer device comprising a camera and a display for displaying the camera images while taking pictures, such as a smart phone, and which is arranged to display a contour on the display in which the person is expected to be positioned while taking said frontal picture. The contour indicates not only where the person should stand, but also should indicate how the arms must be spread. In this manner the accuracy of the process is enhanced.

The invention also relates to a computer programme for determining clothing sizes of persons from digital pictures, arranged to carry out the following steps in a suitable order:

a) importing a frontal digital picture of at least the upper body part of a person while the arms of said person are spread in oblique lateral downward directions, said picture having an upper edge closest to the head of the
person and a lower edge farthest from the head of the person;

b) defining a horizontal line in said picture which is statistically almost certainly located well below the persons armpits;

c) determining on both sides of the vertical centre line of the picture the distances, for instance in pixels, between the pixel of a horizontal line and the first contrasting pixel above said line which has a predetermined significant different colour and/or brightness than the colour and/or brightness of the pixels below it;

d) determining on each side of the vertical centre line an uppermost contrasting pixel having a local maximum determined distance from said horizontal line;

e) determining the distance, for instance in pixels, between said two uppermost contrasting pixels;

f) using said distance between said two uppermost contrasting pixels for calculating a clothing size of said person.

The invention will now be elucidated by means of a preferred embodiment, as shown in the drawings, wherein:

Figure 1 is a frontal digital picture of a person; and

Figures 2 - 10 show various stages of the digital picture while being processed.

Figure 1 shows a frontal digital picture of a man in underwear. This picture may be taken at home with a smartphone having a camera and a display, and using software which is arranged to provide instructions as to how to take the required pictures for ordering clothes online. The
instructions include instructions to take one frontal picture and one lateral picture of the person for whom the clothes are ordered. The instructions also comprise contours on the display of the smartphone for each picture in which the person is expected to be positioned while the picture is being taken. Such a contour for the frontal picture is shown in figure 2. The person is instructed to hold his arms as shown, i.e. spread laterally in oblique downward directions. The process of taking the lateral picture is not shown, but very similar. The person is instructed to hold his arms straight down next to his upper body when taking the lateral picture.

After the pictures have been taken, the person can upload the pictures to the website of an online shop, together with his order, for instance a shirt or a suit. While filling in the order, the person is also asked to fill in his real length.

The received digital pictures and data are then digitally and automatically processed as follows. As shown in figure 3, the digital picture of figure 1 is digitally processed to provide a black on white contour image by using contrast comparison techniques (the image may of course also be white on black, or any other combination of colours). Such processes are well known as such, and need no further explanation here. As shown in figure 4 the pre-defined contour as shown in figure 2 is used again to filter the image, such that all black pixels outside the pre-defined contour are deleted from the image. In the step as shown in figure 5, the black pixels in the image are made bigger by rendering the neighbouring pixels also black. This ensures that a closed contour is obtained. In figure 6 the thus
obtained contour is made thinner again, while ensuring that the contour remains closed. In figure 7, the inner side of the contour is filled with black pixels. In order to determine the inner side of the contour, a face recognition algorithm may be used on the original picture of figure 1. But the inner side of the contour may also be guessed by using a predetermined pixel in the image as the starting point for filling the contour.

In figure 8 a narrowest vertical rectangle is drawn, which touches the outer black pixels on all four sides. In figure 9 a horizontal reference line is drawn at a predetermined height in the rectangle, which statistically is at an average person's hip height.

Figure 10 shows the process to determine the location of the person's armpits, which is carried out on both sides of the vertical rectangle's vertical centre line. The computer programme is arranged to determine for each black pixel on the reference line, the number of white pixels between the pixel on reference line and the nearest black pixel in vertical direction (as shown by the arrows). The computer programme is further arranged to determine for each side the maximum number of white pixels thus determined, and the uppermost black pixel related therewith. The two pixels determined in this manner represent the locations of the person's armpits.

The computer is further arranged to determine the distance in pixels between the two "arm pit" pixels, and to use a chest depth determined from the second, lateral digital picture, and the person's real length as provided by the user and the person's length in pixels determined by the
height of the vertical rectangle of figure 8, to calculate a "real world" chest size, and therewith a clothing size.

In order to further improve the calculation, the height of the person derived from the height of the vertical rectangle of figure 8 is corrected by using face recognition techniques in order to estimate the location of the upper side of the head, instead of the upper side of the hair dress. Also, a correction can be made, for instance by a predetermined factor, for the extra height added to the vertical rectangle by the fact that the outer ends of the feet of the person appear in the picture below the lower side of the heel.

The invention has thus been described by means of preferred embodiments. It is to be understood, however, that this disclosure is merely illustrative. Various details of the structure and function were presented, but changes made therein, to the full extent extended by the general meaning of the terms in which the appended claims are expressed, are understood to be within the principle of the present invention. The description and drawings shall be used to interpret the claims. The claims should not be interpreted as meaning that the extent of the protection sought is to be understood as that defined by the strict, literal meaning of the wording used in the claims, the description and drawings being employed only for the purpose of resolving an ambiguity found in the claims. For the purpose of determining the extent of protection sought by the claims, due account shall be taken of any element which is equivalent to an element specified therein.
Claims

1. Method for determining clothing sizes of persons from
digital pictures, comprising the following steps in a
suitable order:
   a) taking a frontal digital picture of at least the
      upper body part of said person while the arms of said person
      are spread in oblique lateral downward directions, said
      picture having an upper edge closest to the head of the
      person and a lower edge farthest from the head of the
      person;
   b) defining a horizontal line in said picture which is
      statistically almost certainly located well below the
      persons armpits;
   c) determining on both sides of the vertical centre
      line of the picture the distances, for instance in pixels,
      between the pixel of a horizontal line and the first
      contrasting pixel above said line which has a predetermined
      significant different colour and/or brightness than the
      colour and/or brightness of the pixels below it;
   d) determining on each side of the vertical centre line
      an uppermost contrasting pixel having a local maximum
      determined distance from said horizontal line;
   e) determining the distance, for instance in pixels,
      between said two uppermost contrasting pixels;
   f) using said distance between said two uppermost
      contrasting pixels for calculating a clothing size of said
      person.

2. Method in accordance with claim 1, further comprising
the step of, between step a) and step c), digitally
processing said picture such that a contour line of said
person is determined.
3. Method in accordance with claim 2, further comprising the step of, filling the interior of said contour line with a monochrome colour.

4. Method in accordance with claim 2 or 3, further comprising the step of, filling the exterior of said contour line with a different monochrome colour.

5. Method in accordance with any of the previous claims, further comprising the step of determining the length, for instance in pixels, of said person in said picture, and using the real length, for instance in mm, of the person to convert the distance, for instance in pixels, between said armpits in said picture into an actual distance, for instance in mm, between the armpits of said person.

6. Method in accordance with any of the previous claims, further comprising the step of detecting the face of said person, and using said face recognition data to determine the length of the person.

7. Method in accordance with any of the previous claims, further comprising the step of detecting the face of said person, and using said face recognition data to determine the interior side of said contour.

8. Method in accordance with any of the previous claims, further comprising the step of taking a lateral digital picture of at least the upper body part of said person and determining the chest depth, for instance in pixels, and using the chest depth in combination with the distance, for
instance in pixels, determined in step e for calculating a clothing size of said person in step f.

9. Method in accordance with any of the previous claims, wherein in step a a mobile computer programme is used, which is arranged to be loaded on a mobile computer device comprising a camera and a display for displaying the camera images while taking pictures, such as a smart phone, and which is arranged to display a contour on the display in which the person is expected to be positioned while taking said frontal picture.

10. Computer programme for determining clothing sizes of persons from digital pictures, arranged to carry out the following steps in a suitable order:

   a) importing a frontal digital picture of at least the upper body part of a person while the arms of said person are spread in oblique lateral downward directions, said picture having an upper edge closest to the head of the person and a lower edge farthest from the head of the person;

   b) defining a horizontal line in said picture which is statistically almost certainly located well below the persons armpits;

   c) determining on both sides of the vertical centre line of the picture the distances, for instance in pixels, between the pixel of a horizontal line and the first contrasting pixel above said line which has a predetermined significant different colour and/or brightness than the colour and/or brightness of the pixels below it;

   d) determining on each side of the vertical centre line an uppermost contrasting pixel having a local maximum determined distance from said horizontal line;
e) determining the distance, for instance in pixels, between said two uppermost contrasting pixels;

f) using said distance between said two uppermost contrasting pixels for calculating a clothing size of said person.
### A. CLASSIFICATION OF SUBJECT MATTER

**INV. A41H1/02**

According to International Patent Classification (IPC) or to both national classification and IPC

### B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

**A41H**

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

### C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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<tr>
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<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
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* Further documents are listed in the continuation of Box C. 

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**Date of the actual completion of the international search**

21 February 2014

**Date of mailing of the international search report**

28/02/2014

Name and mailing address of the ISA/

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