I (14):
II (20):
III (16):

Schriftliche Prüfung aus Grundlagen der Digitalen Bildverarbeitung WS 2008/2009

Walter G. Kropatsch

Bitte tragen Sie Ihre Matrikelnummer, Ihren Namen und Ihre Studienkennzahl in die dafür vorgesehenen Kästchen ein:

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Diese Prüfung besteht aus drei Teilen auf die Sie insgesamt 50 Punkte erreichen können. Für besonders gute Begründungen können Zusatzpunkte erreicht werden. Die Dauer der Prüfung beträgt 90 Minuten. Es gilt der folgende Notenschlüssel:

Note:	1	2	3	4	5
Punkte:	> 42	37:42	31:36	25:30	0:24

Teil I: Interpretation von Bildoperationen (14)

Im ersten Teiles sollen Sie Ergebnisbilder über vorgegebene Operationen mit den gegebenen Eingabebildern in Beziehung setzen. Auf den folgenden 2 Seiten finden Sie 24 Bilder die als Eingabe als auch als Ergebnis einer Bildoperation auftreten können. Beachten Sie, dass nicht ALLE Bilder verwendet werden, es kann Bilder geben, die nicht als Eingabe- oder Ergebnisbilder aufscheinen.

Matlab Referenz

Allgemeines

Die angegebenen Bilder haben eine Größe von 350x350 Pixeln.
Grauwertbilder haben einen Wertebereich von 0 bis 255 (falls nicht anders angegeben)
Logische Operationen werden im Rahmen der Prüfung nur auf Binärbilder (Schwarz-Weiss-Bilder) angewendet. `true` wird durch den Wert 1 (=weiss) repräsentiert, `false` durch den Wert 0 (=schwarz).

Notationen

Matrix $A = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$ `A=[a b; c d];` *Spaltenvektor* $x = \begin{pmatrix} y \\ z \end{pmatrix}$ `x=[y;z]`

Zeilenvektor $e = \begin{pmatrix} f & g \end{pmatrix}$ `e=[f g]`

Command Reference

`D = bwdist(BW)`

computes the Euclidean distance transform of the binary image BW. For each pixel in BW, the distance transform assigns a number that is the **distance between that pixel and the nearest nonzero pixel** of BW. bwdist uses the Euclidean distance metric by default. D is the same size as BW.

`J=bwlabel(I)`

Label connected components in binary image I.

`BW2 = bwmorph(BW,'skel',n)`

with n = Inf, removes pixels on the boundaries of objects but does not allow objects to break apart. The pixels remaining make up the image skeleton. This option preserves the Euler number.

`C=conv2(A,B)`

computes the two-dimensional convolution of matrices A and B.

`h = fspecial('gaussian',hsize,sigma)`

returns a rotationally symmetric Gaussian lowpass filter of size hsize with standard deviation sigma (positive). hsize can be a vector specifying the number of rows and columns in h

`J = histeq(I,n)`

transforms the intensity image I, returning in J an intensity image with n discrete gray levels. A roughly equal number of pixels is mapped to each of the n levels in J, so that the histogram of J is approximately flat. (The histogram of J is flatter when n is much smaller than the number of discrete levels in I.) The default value for n is 64

`J=imhist(I)`

displays histogram of image data I.

`IM2 = imclose(IM,SE)`

performs morphological closing on the grayscale or binary image IM, returning the closed image, IM2. The structuring element, SE, must be a single structuring element object.

`B = medfilt2(A)`

performs median filtering of the matrix A using the default 3-by-3 neighborhood.

`SE = strel('disk',R)`

creates a flat, disk-shaped structuring element, where R specifies the radius.

`~A`

equals not(A);

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Folgende Liste enthält 10 Bildoperationen, die auf eines oder mehrere (z.B. $Y + Z$) der Bilder A-X angewandt wurden und eines der Bilder A-X als Ergebnis haben. Ihre Aufgabe ist die Rekonstruktion dieser 10 Bildoperationen. Tragen Sie bitte die Bildnamen (`A-X`) in die Kästchen □ der jeweiligen Operation ein. Jede korrekte Antwort wird mit einem Punkt belohnt. Für jene 4 Antworten, die den ersten vier verschiedenen Ziffern Ihrer Matrikelnummer entsprechen (sollten nur 3 verschiedene Ziffern auftreten, so wird durch "4" ergänzt), gibt es einen Punkt zusätzlich für eine korrekte Antwort, einen Abzugspunkt für eine falsche Antwort. Für entsprechend gute und korrekte Begründungen kann es Zusatzpunkte geben, die Verluste in anderen Abschnitten ausgleichen können!

0. `□ = conv2( □ ,fspecial('gaussian',[7 7],1));`

   Begründung: ....

1. `□ = medfilt2( □ );`

   Begründung: ....

2. `□ = histeq( □ );`

   Begründung: ....

3. `□ = bwmorph( □ ,'skel',Inf);`

   Begründung: ....

4. `□ = imclose( □ ,strel('disk',11));`

   Begründung: ....

5. `□ = imclose( □ ,strel('disk',30));`

   Begründung: ....

6. `□ = bwdist( □ );`

   Begründung: ....

7. `□ = imhist(X);`

   Begründung: ....

8. `□ = imhist(T);`

   Begründung: ....

9. `□ = bwlabel( ~□ );`

   Begründung: ....

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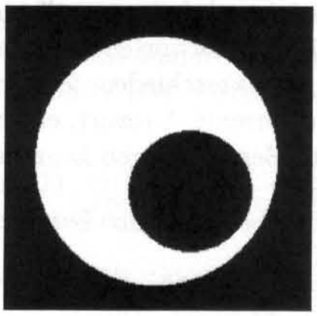
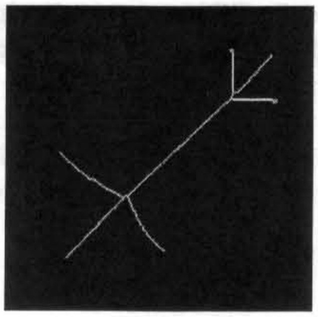
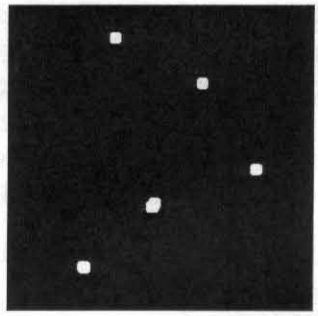
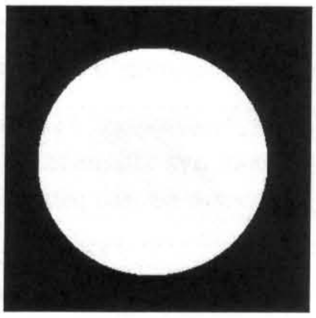
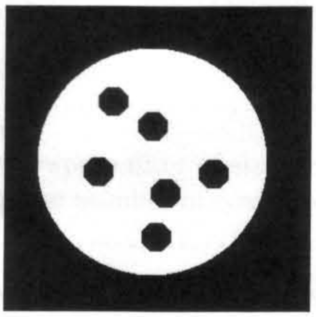
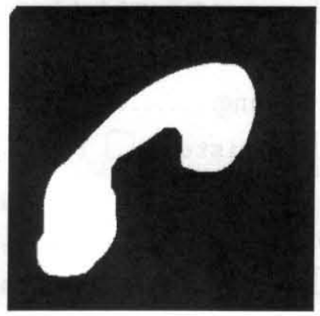
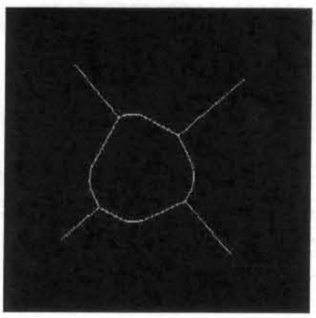
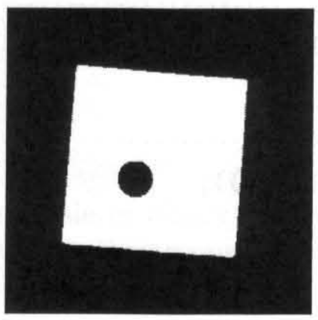
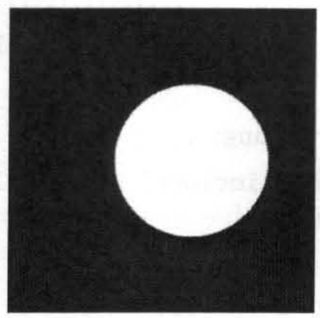
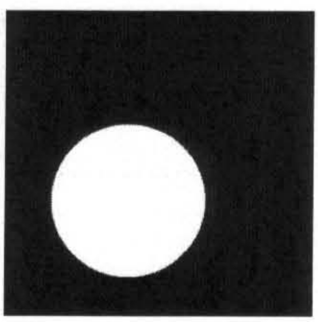
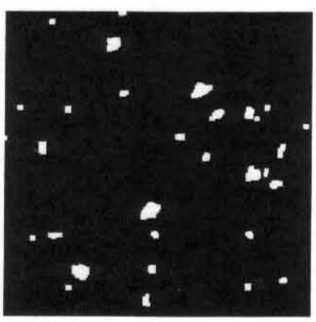
Binärbilder		
A= 	B= 	C= 
D= 	E= 	F= 
G= 	H= 	I= 
J= 	K= 	L= 

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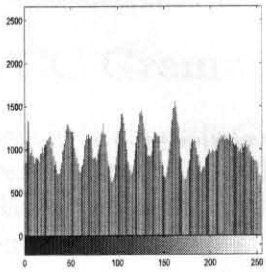
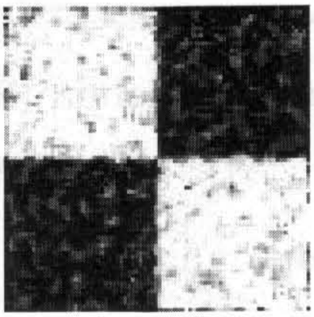
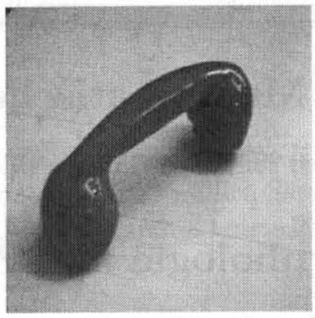
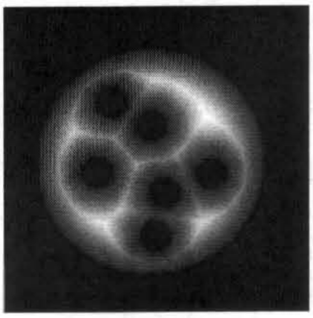
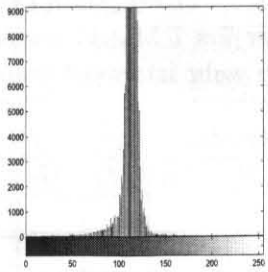
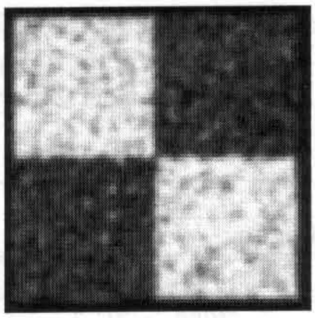
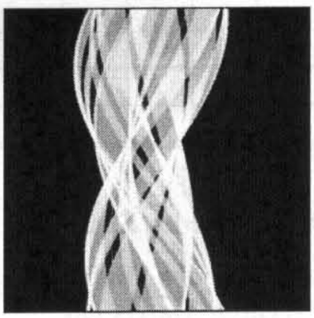
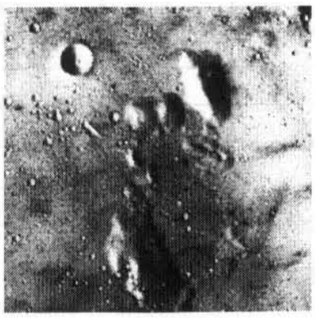
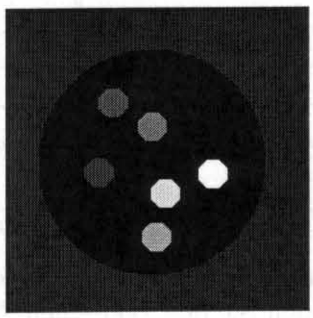
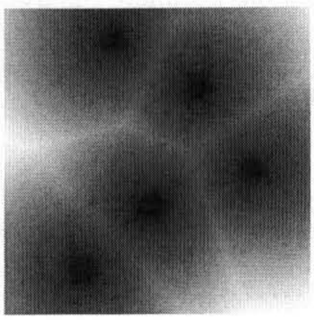
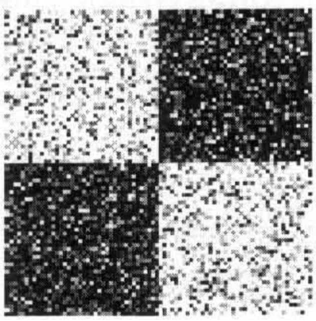
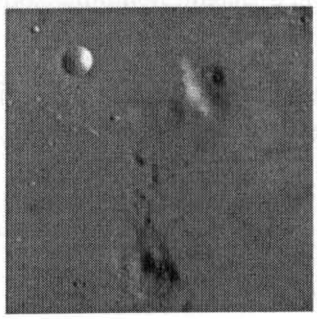
Grauwertbilder		
M= 	N= 	O= 
P= 	Q= 	R= 
S= 	T= 	U= 
V= 	W= 	X= 

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Teil II: Mathematisches Nachvollziehen (20)

In diesem Teil sollen Sie einfache Bildverarbeitungsoperationen numerisch nachvollziehen.

1 Morphologie und Zusammenhang (5)

1. Bezeichne $M_1, M_2, \ldots M_7$ die Ziffern Ihrer Matrikelnummer. Ein Binärbild der Grösse 7×7 wird aus den Ziffern Ihrer Matrikelnummer und dem Maximum $max = \max\{M_i | i = 1, \ldots 7\} = \square$, dem Median $med = \text{median}\{M_i | i = 1, \ldots 7\} = \square$ und dem Minimum $min = \min\{M_i | i = 1, \ldots 7\} = \square$, bestimmt. In jeder Zeile der 7×7 Matrix setzen Sie 1 ein, wenn die Bedingung der linken Spalte mit der Ziffer der Spalte wahr ist, sonst steht 0 (Eintrag einfach freilassen).

Ziffer:M_i	M_1	M_2	M_3	M_4	M_5	M_6	M_7	Ergebnisbild						
Bedingung Wert:								M_1	M_2	M_3	M_4	M_5	M_6	M_7
$= max \leq M_i$														
$= med \leq M_i$														
$= min < M_i$														
$M_i < max \; =$														
$M_i \leq med \; =$														
$M_i < med \; =$														
$M_i \leq min \; =$														

2. Diese Binärmatrix öffnen Sie mit folgendem Strukturelement:

	1
1	1

(OPEN). Jedes Element der Matrix, das nach der Erosion verschwindet, wird mit x gekennzeichnet. Für den Bildrand verwenden Sie den zyklischen Abschluss. Das Ergebnis tragen Sie in der rechten Matrix ein.

3. Wieviele 8-Zusammenhangskomponenten (OHNE zyklischen Abschluss) hat das geöffnete Binärbild? $CC_8 = \square$.

4. Bestimmen Sie für jede Zusammenhangskomponente den Freeman Chain Code des äusseren Randes (0-Pixel mit 1-Nachbar):

   (a) ....

   (b) ....

   (c) ....

   (d) ....

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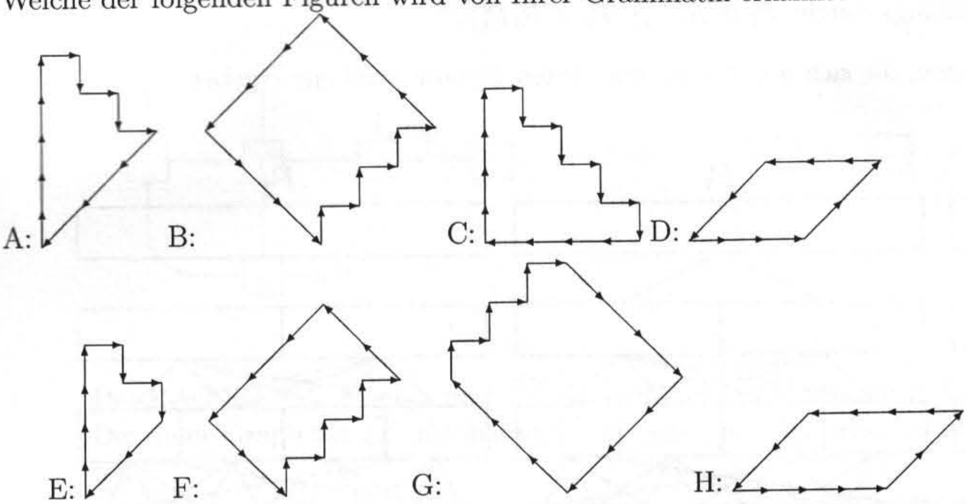
2 FCC Grammatik (5)

Die folgende Grammatik $G = (\{0,1,2,3,4,5,6,7\}, \{A,B,C,D,E,R,S,T\}, S, P)$ erzeugt eine Klasse von Freeman Chain Codes (FCC). Für die Einsetzung der Terminalsymbole (=FCC) wählen Sie bitte jenen Satz von Regeln, der dem Rest Ihrer Matrikelnummer (M) bei Division durch 3 entspricht. ϵ steht für den Nullstring: $\epsilon x = x\epsilon = x$.

$$
\begin{array}{lllll}
P: & S \rightarrow TRE, & R \rightarrow RR, & TE \rightarrow \epsilon, & R \rightarrow ABCD, \\
 & BA \rightarrow AB, & CA \rightarrow AC, & DA \rightarrow AD, & \\
 & CB \rightarrow BC, & DB \rightarrow BD, & DC \rightarrow CD, & \\
\hline
mod(M,3) = 0: & AE \rightarrow E22, & BE \rightarrow E06, & CE \rightarrow \epsilon, & DE \rightarrow E5. \\
mod(M,3) = 1: & AE \rightarrow E44, & BE \rightarrow E5, & CE \rightarrow E00, & DE \rightarrow E1. \\
mod(M,3) = 2: & AE \rightarrow E5, & BE \rightarrow E7, & CE \rightarrow E20, & DE \rightarrow E3. \\
\hline
\end{array}
$$

Welche der folgenden Figuren wird von Ihrer Grammatik erkannt?



Markieren Sie das entsprechende Kästchen mit 'x':

A	B	C	D	E	F	G	H

Welche Folge von Chaincodes wird von der Grammatik erzeugt (formale Sprache, z.B. $2^n4^n6^n0^n$)?

....

Begründen Sie Ihre Wahl mit der Ableitung des konkreten Freeman-Chain Codes

....

....

....

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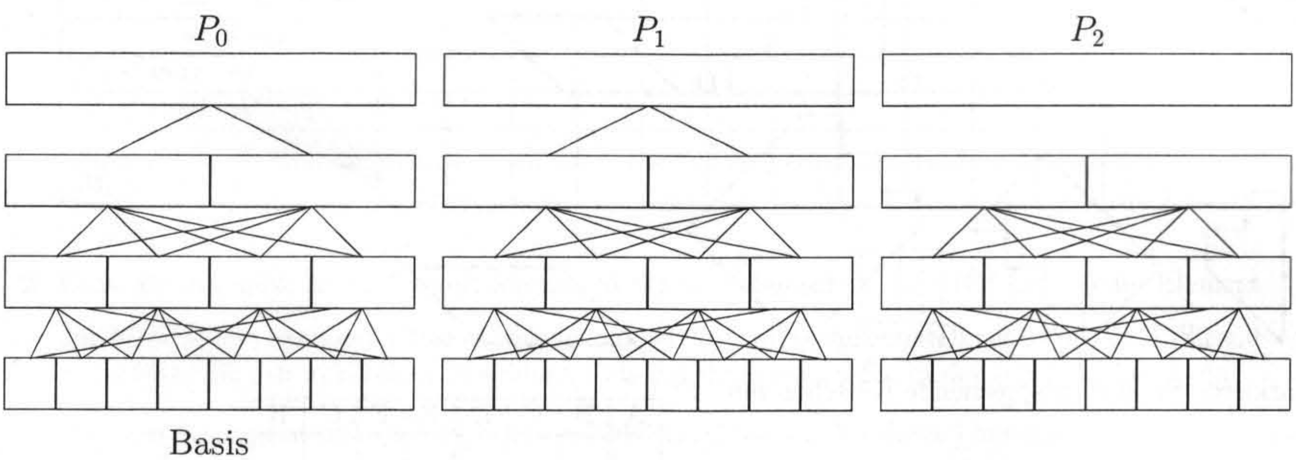
3 Pyramid Linking (5)

1. In die leeren Felder der Basis der Pyramide P_0 tragen sie die Ziffern Ihrer Matrikelnummer $M_1, ..., M_7$ ein. Vor der kleinsten Ziffer Ihrer Matrikelnummer fügen Sie die grösste nicht in Ihrer Matrikelnummer vorkommende Dezimalziffer ein $= \square$.
2. Zur Initialisierung der $2 \times 1/2$ Pyramide P_0 verwenden Sie den **abgerundeten Mittelwert** als Reduktionsfunktion R.
3. Zum Linking wird eine $4 \times 1/2$ Pyramide mit zyklischem Abschluss verwendet. Die Kinder wählen jenen Elternteil (bitte durch Pfeil kennzeichnen), der mit folgender Ähnlichkeitsfunktion den geringsten Unterschied zum eigenen Wert hat: $D(a,b) = \begin{cases} |a-b| & \text{wenn } a-b \text{ gerade ist} \\ |a-b|+4 & \text{wenn } a-b \text{ ungerade ist} \end{cases}$
4. Führe 2 Iterationen des Linkings durch: $P_1 = R(P_0')$, $P_2 = R(P_1')$.
5. Markiere die beiden Segmente, die sich aus der zweithöchsten Pyramidenebene ergeben.



Begründung: ....

....

....

....

....

....

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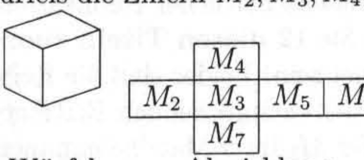
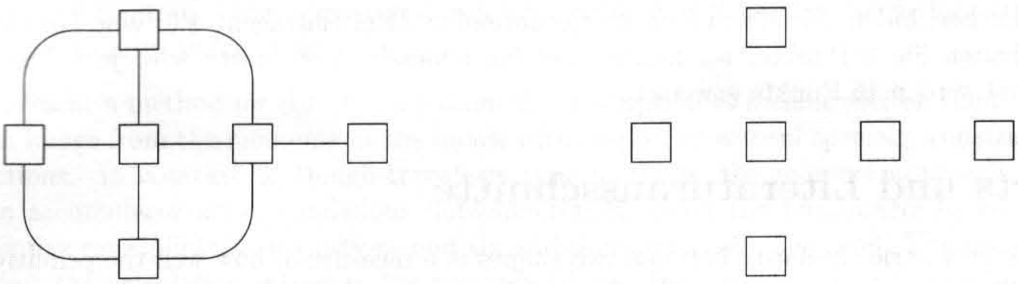
4 Dualer Graph und Kontraktion (5)

1. Füllen Sie in die sechs Flächen des Würfels die Ziffern $M_2, M_3, M_4, M_5, M_6, M_7$ Ihrer Matrikelnummer ein.



Würfel Abwicklung

2. Ergänze die Ziffern Ihrer Matrikelnummer als Attribute der Knoten und die fehlenden Kanten (ohne Kreuzungen!) im folgenden Region Adjacency Graphen (RAG):



Der RAG hat ☐ Knoten und ☐ Kanten.
Der duale Graph hat ☐ Knoten und ☐ Kanten.

Der kontrahierte Graph hat ☐ Knoten und ☐ Kanten.

Die Kästchen des RAG dienen nur der Orientierung

3. Zeichnen Sie den dualen Graphen über den RAG. Die Knoten kennzeichnen Sie mit Kreisen, in die Sie als Attribut **die Summe der Attribute** der begrenzenden Würfelflächen eintragen.

4. Kontrahiere alle Kanten des dualen **Knotens mit maximalem Attribut**. Zeichne das Resultat und übernimm die Knotenattribute.

Begründung: ....

....

....

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Teil III: Selektion von Literatur (16)

In Abschnitt 6 finden Sie 10 Titel wissenschaftlicher Publikationen. In Abschnitt 5 finden Sie 20 Literaturausschnitte (A-T) von denen Sie **12 diesen Titeln zuordnen müssen**. Einem Titel können somit mehrere Ausschnitte zugeordnet sein. Leider sind die Reihenfolge und die Zuordnungen, sowie einige Worte (markiert durch ...) der entsprechenden Beiträge verloren gegangen.

Je nach Wert der LETZTEN Ziffer M_7 Ihrer Matrikelnummer streichen Sie 8 Literaturausschnitte weg:

M_7	Zu streichende Literaturausschnitte
0,1,2,3	A - H
4,5,6	G - N
7,8,9	M - T

Stellen Sie für die übrigen **12 Ausschnitte** (bitte in Abschnitt 1 markieren) die inhaltlichen Zuordnungen wieder her, indem Sie sie zu dem dazugehörenden Titel eintragen. Für eine korrekte Korrespondenz erhalten Sie 2 Punkte, für falsche und für fehlende Ausschnitte wird je 1 Punkt abgezogen. Maximal werden 16 Punkte gewertet.

5 Abstracts und Literaturausschnitte

A Typically, the geometric similarity between two shapes is a measure of how well the primitives forming the shapes and / or their spatial organizations agree [919]. Tree data structure has been widely used for describing shapes,as it provides a natural representation of the inclusion relations of the primitives.When a shape (primitives and their inclusion relations)is represented by a tree,the best corre- spondence between two given shapes can be expressed as the best partial match between their trees.Accordingly, the shape dissimi- larity is computed as the edit distance which is defined as the cost of transforming the first tree into the second one by using node removal, node insertion and attribute change operations [20]. In the shape literature, it is an accepted practice to form tree or graph de- scriptions using shape skeletons, and to match these descriptions us- ing edit distance [12,13,15,16,21]. Typically, these works are generic and they ignore contextual effects,despite the observation that human dissimilarity judgements are biased by the other shapes [5,6,8,2224].

B An orientability measure determines how orientable a shape is; i.e. how reliable an estimate of its orientation is likely to be. This is valuable since many methods for computing orientation fail for certain shapes. In this paper several existing orientability measures are discussed and several new orientability measures are introduced. The measures are compared and tested on synthetic and real data.

C A curve pyramid and an image pyramid are built in a similar way. Filtering, followed by subsampling, are applied to the original signal. Thus, each pyramid level (k) holds a smoothed and subsampled version of the signal at the level below $(k-1)$. ....
... At level $k+1$, the chain-code of node i, C_i^{k+1}, is the average between the chain-codes of nodes $2i$ and $2i+1$ at level k:

$$C_i^{k+1} = [(C_{2i}^k + C_{2i+1}^k + Off)/2]_{mod8}, \quad 0 \leq i < N_{k+1}, \tag{3}$$

where Off takes the following values:

$$Off = \begin{cases} 0 & \text{if } |C_{2i}^k - C_{2i+1}^k| < 4, \\ 8 & \text{if } |C_{2i}^k - C_{2i+1}^k| > 4. \end{cases}$$

D Skeletal trees are commonly used in order to express geometric properties of the shape. Accordingly, tree-edit distance is used to compute a dissimilarity between two given shapes.We present a new tree-edit based shape matching method which uses a recent coarse skeleton representation. The coarse skeleton representation allows us to represent both shapes and shape categories in the form of depth-1 trees. Consequently,we can easily integrate the influence of the categories in to shape dissimilarity mea- surements. The new dissimilarity measure gives a better within group versus between group separation, and it mimics the asymmetric nature of human similarity judgements.

E We present a method for deriving a parametric description of a conic section (quadratic curve) in an image from the moments of the image with respect to several specially constructed kernel functions. In contrast to Hough-transform-type methods, the moment approach requires no large accumulator array. Judicious implementation allows the parameters to be determined using five multiplication operations and six addition operations per pixel. The use of moments renders the calculation robust in the presence of high-frequency noise or texture and resistant to small-scale irregularities in the edge. Our method is generalizable to more complex classes of curves with more parameters and to surfaces in higher dimensions.

F **Elongation** Consider the covariance matrix constructed from the second order central moments of the shape

$$C = \begin{vmatrix} \mu_{20} & \mu_{11} \\ \mu_{11} & \mu_{02} \end{vmatrix}. \tag{1}$$

The eigenvalues of C denoted by I_1 and I_2 provide the variances of the shape along the major and minor principal axes. and can be used to form a measure of elongation [5], which in turn is an indication of ...

G The color of mouth region contains stronger red component and weaker blue component than other facial regions. Hence, the chrominance component C_r is greater than C_b in the mouth region. We further notice that the mouth has a relatively low response in the C_r/C_b feature, but it has a high response in C_r^2. We construct the mouth map as follows:

$$MouthMap = C_r^2 \cdot \left(C_r^2 - \eta \cdot C_r/C_b\right)^2, \qquad (2)$$

$$\eta = 0.95 \cdot \frac{\frac{1}{n}\sum_{(x,y)\in\mathcal{FG}} C_r(x,y)^2}{\frac{1}{n}\sum_{(x,y)\in\mathcal{FG}} C_r(x,y)/C_b(x,y)}, \qquad (3)$$

where both C_r^2 and C_r/C_b are normalized to the range $[0, 255]$, and n is the number of pixels within the face mask, $\mathcal{FG}$. The parameter η is estimated as a ratio of the average C_r^2 to the average C_r/C_b.

H Haralicks coefficients are usually calculated from the average co-occurrence matrix obtained by averaging the matrices calculated for 0°, 45°, 90°, and 135° directions. The matrices are computed for one or several, experimentally selected, distance parameter values. In most of the cases, Haralicks coefficients utilized are calculated for only one distance parameter value. In this work, we propose a different ways of exploiting the information contained in Haralicks coefficients computed using several distance parameter d_i values. Rather than carefully selecting an appropriate distance parameter value, the information gathered in the co-occurrence matrices computed for several distance parameter values is efficiently utilized.

I However, local appearance is clearly not the only cue to object detection, and in fact for some classes of objects the local appearance contains very little information, while they are easily recognised by the shape of their contour (see Fig. 1). Detection by shape has been investigated in earlier work. The basic idea common to all methods is to define a distance measure between shapes, and then try to find minima of this distance. A classical method is chamfer matching [69], in which the distance is defined as the average distance from points on the template shape to the nearest point on the image shape. However, it has been repeatedly noted that chamfer matching does not cope well with clutter and shape deformations, e.g. Ref. [10]. Even if a hierarchy of many templates is used to cover deformations, the rate of false positives is rather high (typically > 1 false positive per image, FPPI).

J The design of a pattern recognition system essentially involves the following three aspects: 1) data acquisition and preprocessing, 2) data representation, and 3) decision making. The problem domain dictates the choice of sensor(s), preprocessing technique, representation scheme, and the decision making model. It is generaly agreed that a well-defined and sufficiently constrained recognition problem (small intraclass variations and large interclass variations) will lead to a compact pattern representation and a simple decision making strategy. ... The four best known approaches for pattern recognition are: 1) template matching, 2) statistical classification, 3) syntactic or structural matching, and 4) neural networks.

K Interest in computing parametric descriptions of lines and conics in images has been rekindled by new image coding schemes based on approximating images with geometrical elements such as wedgelets and curvelets [8], [31], [23] and by the opportunity to reduce ringing artifacts in compressed images [28]. For such applications, resistance to noise, computational speed, and memory requirements are major concerns. Moment-based techniques have long been recognized as well suited in this context, and an extensive body of theoretical and computational results has been developed.

L In this paper, a new method has been introduced for the characterisation of contours by means of the hierarchical computation of a multiresolution structure. This structure, consisting of successive lower resolution versions of the contour, is obtained by progressively averaging and subsampling of the chain-code of the original curve. This results in a bounded total number of nodes, which corresponds approximately to twice the number of nodes in the contour ($2N_0 + M - 3$ in the worst case).
Once the pyramid is built, a stable parent-son link structure is built between nodes of adjacent levels. This applies the concepts of linked pyramid and MPL algorithm and rapidly converges to a stable solution.

M We present a method for object class detection in images based on global shape. A distance measure for elastic shape matching is derived, which is invariant to scale and rotation, and robust against nonparametric deformations. Starting from an over-segmentation of the image, the space of potential object boundaries is explored to find boundaries, which have high similarity with the shape template of the object class to be detected. An extensive experimental evaluation is presented. The approach achieves a remarkable detection rate of 8391

N In this paper, we propose a new method to characterise a curve by means of the hierarchical computation of a multiresolution structure. This structure, consisting of successive lower resolution versions of the same object, is processed using the linked pyramid approach. We adapt the multiresolution pixel linking algorithm to the processing of curve contours which are described by their chain-code. We also introduce a selective class selection process which allows application of the algorithm to segmentation and detection of contour features. The resulting framework presents good performance for a wide range of object sizes without the need of any parameter tweaking, and allows detection of shape detail at different scales.

O Nonetheless, the fact that the approach was proposed more than 30 years ago, the coefficients still remain amongst the most popular and the most discriminative types of texture features [8].

P Skeletal trees are commonly used in order to express geometric properties of the shape. Accordingly, tree-edit distance is used to compute a dissimilarity between two given shapes.We present a new tree-edit based shape matching method which uses a recent coarse skeleton representation. The coarse skeleton representation allows us to represent both shapes and shape categories in the form of depth-1 trees. Consequently,we can easily integrate the influence of the categories in to shape dissimilarity mea- surements. The new dissimilarity measure gives a better within group versus between group separation, and it mimics the asymmetric nature of human similarity judgements.

Q Suppose the input gray image with size $N \times N$ has been compressed into the compressed image via quadtree and shading representation. Assume that the number of blocks in the representation is B, commonly $B < N^2$ due to the compression effect. This paper first derives some closed forms for computing the mean/variance of any block and for calculating the two statistical measures of any merged region in O(1) time. It then presents an efficient $O(B\alpha(B))$-time algorithm for performing region segmentation on the compressed image directly where $\alpha(B)$ is the inverse of the Ackerman's function and is a very slowly growing function. With the same time complexity, our results extend the pioneering results by Dillencourt and Samet from the map image to the gray image.

R We test our constructions on a shape retrieval problem by per- forming two separate experiments. In the first experiment, we com- pute dissimilarities between every pair in the database, and retrieve the closest shapes to any given shape. In very large shape databases, a single retrieval task becomes computationally intractable when an exhaustive search strategy is used,i.e. by comparing the query shape with all the database shapes.Comparing the query shape to a group of shapes, at once, can speed up the process. Accordingly, in the sec- ond experiment, we exploit structural equivalence of the shape and the category trees, in order to use our constructions for comparing a shape to a category. Experiments are conducted on two different data sets consisting of 180 and 1000 shapes, respectively.The first data set is identical to the one used in Refs. [31,32], in order to facilitate a comparison. The second dataset is formed by extending the first set with shapes collected from various sources [11,44].

S Before presenting our proposed region-segmentation algorithm on the S-tree representation, we first present an efficient method for calculating the mean and the variance of a block in O(1) time. The calculated mean and the variance of one block will be used in the region-merging process.

T We test our constructions on a shape retrieval problem by per- forming two separate experiments. In the first experiment, we com- pute dissimilarities between every pair in the database, and retrieve the closest shapes to any given shape. In very large shape databases, a single retrieval task becomes computationally intractable when an exhaustive search strategy is used,i.e. by comparing the query shape with all the database shapes.Comparing the query shape to a group of shapes, at once, can speed up the process. Accordingly, in the sec- ond experiment, we exploit structural equivalence of the shape and the category trees, in order to use our constructions for comparing a shape to a category. Experiments are conducted on two different data sets consisting of 180 and 1000 shapes, respectively.The first data set is identical to the one used in Refs. [31,32], in order to facilitate a comparison. The second dataset is formed by extending the first set with shapes collected from various sources [11,44].

6 Welche Ausschnitte gehören zu folgenden Titel ?

0 Dissimilarity between two skeletal trees in a context

Ausschnitt(e): ....

Begründung(en): ....

1 Statistical Pattern Recognition: A Review

Ausschnitt(e): ....

Begründung(en): ....

2 Measuring the Orientability of Shapes

Ausschnitt(e): ....

Begründung(en): ....

3 Increasing the discrimination power of the co-occurrence matrix-based features

Ausschnitt(e): ....

Begründung(en): ....

4 Face Detection in Color Images

Ausschnitt(e): ....

Begründung(en): ....

5 Curve Parameterization by Moments

Ausschnitt(e): ....

Begründung(en): ....

6 Object detection by global contour shape

Ausschnitt(e): ....

Begründung(en): ....

7 Corner detection and curve segmentation by multiresolution chain-code linking

Ausschnitt(e): ....

Begründung(en): ....

8 Dissimilarity between two skeletal trees in a context

Ausschnitt(e): ....

Begründung(en): ....

9 Efficient region segmentation on compressed gray images using quadtree and shading representation

Ausschnitt(e): ....

Begründung(en): ....