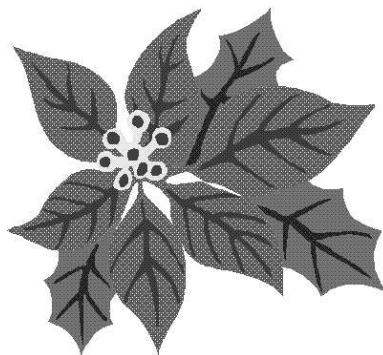


SVENSKA
SÄLLSKAPET
FÖR
AUTOMATISERAD
BILDANALYS

SWEDISH
SOCIETY
FOR
AUTOMATED
IMAGE ANALYSIS

MEMBER OF THE
INTERNATIONAL
ASSOCIATION FOR
PATTERN
RECOGNITION

SSABlaskan



ORDFÖRANDES ORD

Nu närmare vi oss slutet på år 2001. Det har varit intensivt på sista tiden i många akademiska grupper inför en stor ansökan till stiftelsen för strategisk forskning. I skrivande stund är den färdig och skickas in. Tidigare har många aktiviteter ordnats genom forskningsprogrammet VISIT. Vi hoppas att nästa program VITAMIN går genom och att den kan betyda lika mycket för sammanhållningen av metodforskningen inom bildanalys i Sverige.

Nästa år hålls föreningens symposium och årsmöte i Lund. Datumet är satt till 7-8 mars. Deadline för att skicka in bidrag är 7 februari 2002. Skicka in bidraget elektroniskt i postscript eller pdf format till kalle@maths.lth.se. Varje bidrag får maximalt vara 4 sidor. Mer information om konferensen kommer så småningom på föreningens hemsida www.maths.lth.se/ssab

En God Jul och ett Gott Nytt År önskar,

Kalle Åström

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Hej!

Här kommer sista Blaskan för året och vi hoppas att ni har haft nytta och glädje av den information vi har spridit genom Blaskan. Vi vill rikta ett speciellt tack till de doktorander som har varit kontaktpersoner i de olika bildanalysgrupperna i Sverige och som har bidragit med information till Blaskans "ditt & datt". Vi hoppas att informationsutbytet fortsätter även nästa år!

Från oss alla, till er alla, en riktigt god jul!



Era Basketomtar

EXPLOATERINGSSTÖDET - VISIT

Under hösten har styrelsen för VISIT utlyst ett stöd för vidareutveckling av forskningsresultat, det s.k. exploateringsstödet, främst avsett för forskare i VISIT-programmet som disputerat eller som kommer att disputera under 2002. Tre ansökningar inkom till deadline som var 30 september.

Anders Kaestner, Högskolan i Halmstad sökte om medel för

att vidareutveckla sin forskning, efter examen, i form av postdoktorala studier vid ETH i Zurich, 6 månader. Roger Lundqvist, CBA, Uppsala Universitet, ansökte om 6 månaders lönestöd för produktifiering av Computerized Brain Atlas (CBA), och Fredrik Bergholm, Uppsala Universitet sökte 95 kSEK, för stöd till prototyp avseende optisk uppfinning.

Styrelsen för VISIT har ställt sig positiv till alla tre ansökningarna. Anders Kaestners och Fredrik Bergholms ansökningar är beviljade, och Roger Lundqvists ansökan kan beviljas så snart som kompletterande information inkommit.

Fredrik Bergholm, CBA

IRISH MACHINE VISION AND IMAGE PROCESSING

Den irländska konferensen Irish Machine Vision and Image Processing Conference (IMVIP 2001) gick av stapeln den 5 till 7 september i Maynooth, ca 30min från Dublin.

Årets upplaga arrangerades av Adam Winstanley och hans kollegor vid Department of Computer Science vid National University of Irland (NUI) i Maynooth. Konferensen gick parallellt med en annan konferens om artificiell intelligenta, nämligen The 12th annual Irish conference in Artificial Intelligence and Cognitive Science (AICS 2001), och en session med inbjudna talare samt konferensmiddagen anordnades gemensamt för de båda konferenserna.

Årets IMVIP var en förhållandevis lite konferens, vilket gjorde att det fanns goda möjligheter att prata med alla deltagare och stämningen bland forskarna var avspänd.

Antalet presentationer uppgick till 26 stycken muntliga föredrag om 20 minuter vardera (inklusive tid till frågor) samt en postersession med 11 stycken posters. Ungefär 50 personer besökte IMVIP varav flertalet av deltagarna kom från Brittiska öarna, men totalt var 12 länder representerade med besökare från både Nya Zeeland och Canada. Totalt uppgick antalet besökare för båda konferenserna (IMVIP & AICS) till cirka 120 personer.

Paul Joe från Canada fick mottaga priset för bästa prestation då han trots sin svåra sjukdom orkar forska och åka så långt som till Europa på konferens. Paul Joe presenterade ett intressant arbete som han och hans medarbetare gjort om att automatiskt följa stormar genom att mäta nederbördsreflektion med hjälp av nya 3-dimensionella Doppler radarbilder. Varje dataset består av 15 lager med densitet och radial hastighet av rörlig nederbördsreflektionsdata. Genom att göra om 2-D fuzzy algebra metoder till att även fungera i 3-D har de kunnat visa att stormar faktiskt rör sig i alla 3 dimensioner. Övriga presentationer behandlade olika områden inom bildanalys som fingeravtryck, medicinska tillämpningar, stereo vision, forskning på ERS radarbilder och SeaWifs bilder m.m.

IMVIP var en förhållandevis välordnad konferens till låg kostnad, där fokus låg på utbyte av forskningserfarenheter. Vi bodde i studentrum i nära anslutning till konferensen och konferenslokaler var mycket bra med väl fungerande utrustningar. Däremot lämnade informationen på konferenshemsidan en del att önska före konferensen

eftersom uppdateringen var sporadisk och orsakade resande utifrån endel bekymmer. Ett annat problem för arrangörerna var att endel av de långväga talarna inte dök upp och inte meddelade det innan vilket orsakade endel programändringar som märktes tydligt på den lilla konferensen. Sammanfattningsvis var det dock en givande konferens som medförde goda chanser för fortsatta forskningsutbyten.

De olika sessionerna

1. Medical Imaging
2. Motion
3. 3D Imaging
4. Image Processing 1
5. Applications
6. Compression and Coding
7. Image Processing 2
8. Poster session

Inbjudna talare

- AI and the cinema - does artificial insanity rule? Robert Fischer, University of Edinburgh.
- Stabler augmented reality through projective geometry. Robert Fischer, University of Edinburgh.
- Eye movements in reading: models, problems, and prospects. Ronan Reilly, University of College Dublin.
- "Digital Rails" for New Urban Transport Systems. Etienne Rose, Matra Systems & Information.
- Recovering 3D structure and camera motion from uncalibrated video sequences. Andrew W. Fitzgibbon, University of Oxford.

Bästa prestation

3D storm tracking in 3D doppler precipitation reflectivity datasets W. Qui, R.E Mercer, J.L. Barron - University of Western Ontario; P. Joe - Atmospheric Environmental Services (AES)

Anna Rydberg, CBA

INTERNATIONAL CONFERENCE ON IMAGE ANALYSIS AND PROCESSING

International Conference on Image Analysis and Processing (ICIAP 2001) hölls 26-28 september 2001 i Palermo, Italien

Vartannat år hålls ICIAP i Italien och årets upplaga var den 11 i ordningen och arrangerades av University of Palermo. Det var andra gången som ICIAP anordnades i just Palermo. Konferensen behandlade olika aspekter inom bildanalys och årets muntliga sessioner handlade om objekt- och formbeskrivning, ansiktsgenkänning, extraktion av olika egenskaper, bildsegmentering, bildkompression, tillämpningar och mycket mer. Många presentationer handlade om bildmatchning, rörelsedetektion och trackning. Ett brett utbud med olika bildanalysmetoder var representerat. Tyvärr hade arrangörerna gjort en liten miss genom att placera en postersession med samma innehåll som en muntlig session vid samma tidpunkt. Detta medförde att personer intresserade av det ämnesområdet missade delar som de kanske skulle ha besökt annars. Konferensen var i år också förhållandevis dyr. En betydande prishöjning från föregående års konferenser hade gjorts utan att kvalitet höjts i samma takt. Det allmänna intrycket om konferensen, var att den vaVartannat år hålls ICIAP i Italien och årets upplaga var den 11 i ordningen och arranger Alla inbjudna talare var oerhört proffsiga. Jiterendra Malik från UC Berkley i USA som främst arbetar med mänskligt seende och segmentering hoppades att man i framtiden ska komma på en metod som

kan ta reda på vad för sorts bildinformation du tittar på lokalt i bilden för att kunna anpassa val av segmenteringsmetod till lokala platser i bilden, eftersom olika segmenteringsmetoder passar för att detektera olika saker. Föredraget presenterade ingen färdig metod utan talade mest om visioner och framtida forskningsområden.

Ett annat intressant föredrag höll t.ex. H. Wang, från NOKIA research i Kina. Han berättade om en metod att med hjälp av en kombinerad mobiltelefon och digitalkamera i framtiden kunna ta kort på t.ex. en vägs skylt i ett främmande land. Bilden analyseras sedan med hjälp av bildanalysmjukvara inuti telefonen/kameran som extraherar fram tecknen du fotat och tolkar dess betydelse. H. Wang arbetade främst med att extrahera och tolka kinesiska tecken. Deras metod arbetar i HSI rymden istället för RGB och metoden fungerar på en mängd olika bakgrunder och i olika ljusförhållanden. Deras nuvarande metod lyckas med 70 % säkerhet ta fram tecknen och tyda vad där står.

Tyvärr blev det inte någon presentation av de föredragshållare som fick pris för bästa artikel. Terror attacken i USA satte sina spår även på denna konferens i Italien och vinnarna kunde p.g.a. svårigheter att transportera sig från USA inte närvara vid konferensen. Arrangörerna brukar normalt inte dela ut priset till icke-närvarande föredragshållare, men gjorde i detta fall ett undantag.

Fakta

| | |
|--------------------------------------|--|
| Inkomna artiklar: | 144 st |
| Accepterade artiklar: | 98 st (66 % av inkomna artiklar accepterade) |
| Muntliga presentationer: | 40 st, indelade i 11 sessioner |
| Poster session: | 58 st uppdelade på 4 sessioner |
| Antal representerade nationaliteter: | 33 st |

Inbjudna talare

- Prof. Andrew Blake, Microsoft Research, Cambridge, UK, Integrated trackning with vision and sound.
- Prof. Jean-Marc Chassery, Laboratoire LIS, ENSIEG, FR, Digital geometry fundaments.
- Prof. Jitendra Malik, UC Berkely, USA, Visual grouping and object recognition.

Pris för bästa artikel på konferensen

Bayesian Face Recognition with Deformable Image Models. B. Moghaddam, C. Nastar & A. Pentland. Mitsubishi (USA), INRIA (FR), MIT (USA).

Anna Rydberg & Hamed Hamid Mohammed, CBA

 DETTA VAR 2001-DISPUTATIONERNA

“Cone-beam reconstruction using filtered
backprojection”
ISY, Linköping
February 2001
Henrik Turbell

The art of medical computed tomography is constantly evolving and the last years have seen new ground breaking systems with multi-row detectors. These tomographs are able to increase both scanning speed and image quality compared to the single-row systems more commonly found in hospitals today. This thesis deals with three-dimensional image reconstruction algorithms to be used in future generations of tomographs with even more detector rows than found in current multi-row systems.

The first practical algorithm for three-dimensional reconstruction from cone-beam projections acquired from a circular source trajectory is the FDK method. We present a novel version of this algorithm that produces images of higher quality. We also formulate a version of the FDK method that performs the backprojection in $O(N^3 \log N)$ steps instead of the $O(N^4)$ steps traditionally required.

An efficient way to acquire volumetric patient data is to use a helical source trajectory together with a multi-row detector. We present an overview of existing reconstruction algorithms for this geometry. We also present a new family of algorithms, the PI methods, which seem to surpass other proposals in simplicity while delivering images of high quality.

The detector used in the PI methods is limited to a window that exactly fits the cylindrical section between two consecutive turns of the helical source path. A rebinning to oblique parallel beams yields a geometry with many attractive properties. The key property behind the simplicity of the PI methods is that each object point to be reconstructed is illuminated by the source during a rotation of exactly half a turn. This allows for fast and simple reconstruction.

“High quality frequency modulated halftoning”
ITN, Campus Norrköping
March 2001
Sasan Gooran

The fact that most printing and display devices, such as computer displays and laser printers, are restricted to very few colors has led to an increased interest in finding efficient methods that transform a continuous-tone image into a binary one. Such methods are referred to as halftoning methods. Contrary to continuous-tone images, halftoned images can be printed or displayed using a multi-level device. The quality of the printed or displayed images depends a great deal on the characteristics of the halftoning method. Many halftoning techniques have been proposed. Some of them are simple but produce halftoned images of low quality. There is also another type of halftoning methods, iterative halftoning methods, which are more complicated and time consuming but produce images of high quality. The methods presented in this thesis belong to this type of halftoning methods. Due to the fast increase of computer power this type of halftoning techniques is becoming more and more popular. This thesis presents a short background of printing and halftoning and describes a few of the existing and known halftoning algorithms. This is followed by the presentation of a novel iterative halftoning technique for monochromatic images. The number of dots to be placed in the entire halftoned image or different parts of it is decided in advance. A filter used within the method controls the dot placement. To have a clue about the quality of halftoned images some criteria are discussed and examined for different images. The method for monochromatic images is extended to a color halftoning method that halftones the color separations of the original image dependently. In this method the dots in different separations are prevented from being placed on top of each other as much as possible. The color shifts that might occur due to the dot-off-dot strategy used in this method is avoided by transforming the original image to a new one before the halftoning process is performed. Dot gain is sometimes considered as an unwanted effect and therefore should be controlled in order to increase the quality of printed halftone images. Optical dot gain is briefly discussed and some simulations for it are carried out.

“Geometry and critical configurations of multiple
views”
Matematikcentrum, Lund

September 2001
Fredrik Kahl

Avhandlingen behandlar ett centralt problem inom datorseende, nämligen att rekonstruera en verklig scen från ett antal bilder av den. Sambanden mellan kamera geometrin, scenen och dess bilder härleds och analyseras. Basen för studien är projektiv geometri, där affin och euklidisk geometri betraktas som specialfall av projektiv geometri.

Traditionellt inom datorseende används huvudsakligen punktkorrespondenser för rekonstruktion. I den första delen av avhandlingen analyseras, förutom punkter, projektioner av linjer, kägelsnitt, kurvor och ytor i många vyer. Flera nya rekonstruktionsalgoritmer är beskrivna som utnyttjar olika typer av geometriska objekt samtidigt.

Den andra delen av avhandlingen handlar om nödvändiga och tillräckliga villkor för att uppnå en unik rekonstruktion. Ett klassiskt resultat är att för två bilder och godtyckligt många punkter så uppnås detta om och endast om både kameror och punkter inte ligger på en enmantlad hyperboloid. Sådana ytor studerades redan i början av 1900-talet av tyska fotogrammetriker och kallas "gefährlichen Örter", vilket betyder farliga eller kritiska ytor. Detta resultat är generaliserat till godtyckligt många vyer. En komplett klassificering av kritiska ytor/konfigurationer för den endimensionella kameran och för autokalibrering är också utförd.

"Laser sheet imaging and image analysis for
combustion research"
Chalmers, Göteborg
October 2001
Rafeef Abu-Gharbieh

This Thesis presents techniques that aim at exploiting the potential of image analysis and processing in order to solve problems of data reduction, interpolation, quantification, and interpretation within the field of experimental laser imaging of combustion processes.

Combustion is the most important source of energy for power generation, heating, and transportation in the world today and its strong dominance is projected to continue in the foreseeable future. There are, however, many concerns regarding health effects and risks on humans, environmental pollution, climate changes, as well as availability of

fuel resources, fuel cost, and competing markets. Therefore, a great interest in studying and better understanding the combustion processes emerged within the academic and industrial communities. Laser based optical diagnostics has been proven to be a valuable tool for characterizing combustion processes in great detail. These methods are appreciated for their ability to combine non-intrusiveness with sensitivity and selectivity for specific chemical species.

The first part of the Thesis deals with the analysis of spray images obtained through the application of tunable excimer lasers to spray diagnostics. The aim is to form a better understanding of the spray behavior, which may in turn lead to performance improvements in many applications of sprays in aerosols and combustion systems. The images of fuel sprays are experimentally produced by planar laser imaging where Mie scattered light from a cross section of the spray is imaged onto a CCD detector. Spray characterization then involves analyzing the resulting images by segmenting the sprays and investigating a number of their characteristics such as the cross sectional area, perimeter, and penetration length. Also, since the studied sprays are optically dense, a method for compensating laser attenuation based on the inversion of Beer Lambert's law is developed.

The second part of the Thesis deals with the analysis of flame images obtained through the application of time resolved laser imaging to turbulent combustion diagnostics. The data is produced by planar laser induced fluorescence (PLIF) imaging, where a laser diagnostic system for high speed spectroscopic imaging is used to record image sequences with very high frame rates (several kHz). Images reflecting the OH radical concentrations in flames are used to investigate the flame front structure in both non-premixed jet flames and spark ignited premixed flames. The aim is to study the influence of fluid motion and reaction chemistry on flame structure, velocity, topology etc. Image analysis methods for edge preserving smoothing, segmentation, tracking, frequency domain interpolation, and velocity estimation are developed for these purposes. Curve matching based on the computation of geodesic paths is used to track (interpolate) the flame motion. Implicit representations incorporating level set methods are deployed to allow proper handling of complex flame front curves with arbitrary topology present in high turbulence scenarios. Finally, a scheme which combines high

speed PLIF imaging of OH with particle image velocimetry (PIV), is used to facilitate the separation of the effects of flow and chemistry on local flame front velocities and structures.

In conclusion, the work presented in this Thesis, which applies image analysis techniques to laser sheet imaging data, represents novel approaches for analyzing time resolved combustion processes both qualitatively and quantitatively. This will provide insight into fundamental mechanisms of turbulent combustion and a better understanding of such processes.

“Towards intelligent deformable models for
medical image analysis”

Chalmers, Göteborg

October 2001

Ghassan Hamarneh

Abstract Medical imaging continues to permeate the practice of medicine, but automated yet accurate segmentation and labeling of anatomical structures continues to be a major obstacle to computerized medical image analysis (MIA). Deformable models, with its profound roots in estimation theory, optimization, and physics-based dynamical systems, represent a powerful approach to the general problem of medical image segmentation. This Thesis presents a number of novel contributions to the field of deformable modeling, and includes theory as well as application. In the first part of the Thesis, a modified Active Contour Model (ACM), utilizing adaptive inflation reversal and damping, is applied to segmenting oral lesions in color images. In the second part, the amalgamation of Active Shape Models (ASM) and ACM into a technique, that harnesses the powers of both, is applied to locating the left ventricular boundary in echocardiographic images. The third part of the Thesis discusses the development of two methodological extensions for spatio-temporal image analysis: Optical flow-based contour deformations, applied to contrast agent tracking in echocardiographic image sequences, and deformable spatio-temporal shape models for extending 2D ASM to 2D+time. The fourth part describes the use of a new Hierarchical Regional Principal Component Analysis, and presents two methods for interactive and learned, localized and multiscale, controlled shape deformation: medial-based shape profiles and physics-based shape deformations. In the final part of the

Thesis, we develop Deformable Organisms: a robust decision-making framework for MIA that combines bottom-up, data-driven deformable models with top-down, knowledge-driven processes in a layered fashion inspired by Artificial Life modeling concepts. We present different segmentation and labeling examples of various anatomical structures from medical images and conclude that deformable organisms represent a promising new paradigm for MIA.

“Probabilistic tracking and reconstruction of 3D
human motion in monocular video sequences”

CVAP, KTH, Stockholm

November 2001

Hedvig Sidenbladh

The tracking and reconstruction of articulated human motion in 3D is a problem that has attracted a great deal of interest in the last years. A system that recovers 3D body pose from video sequences has applications in vision-based human-computer interaction, marker-less motion capture, animation, surveillance and entertainment such as computer games.

The fast, non-linear motion and complicated appearance of humans and the large number degrees of freedom of the human body make the tracking problem a difficult one. To address these problems, a system for tracking and reconstruction of human motion in 3D should possess the following: A strong model for the appearance of humans in images; a model of how people move; and an effective strategy for searching for the right pose in each time step. In previously presented systems, the most common way of addressing these issues has been to constrain the problem domain. The appearance of humans could be constrained by assuming certain clothing and a large contrast between the human and the background. Furthermore, by adding more camera views, more information about the 3D pose of the human can be extracted and ambiguities reduced, thus making the problem easier.

The goal of this thesis is to investigate to which extent the general problem of tracking and reconstructing human motion can be solved, using only a monocular camera view. Thus, no assumptions of the appearance of either the human or the background are introduced.

The thesis makes three contributions: A probabilistic framework for the articulated tracking of human figures in 3D; a filter-based learned model of

human appearance in images and image sequences; and three different types of models of human motion, intended to constrain the search in each time step of the tracking. Successful tracking results using the human appearance model and all three motion models are presented. Among the questions left open is the issue of initialization, a difficult problem in the high-dimensional search space of an articulated model in 3D.

The contributions of this thesis provide a small step on the way towards robust and accurate articulated 3D tracking of humans in monocular sequences.

“Multispectral image analysis for extraction of remotely sensed features in agricultural fields”

CBA, Uppsala
November 2001
Anna Rydberg

Remotely sensed images have been used for a long time in agriculture for measuring different crop characteristics. Often, different types of interactive classification systems are used when processing satellite data. Automated extraction of agricultural features from remotely sensed images is of interest in many applications in agriculture, such as, surveillance, precision agriculture, and crop prediction, to mention a few.

In this thesis, new and existing methods for automated delineation of agricultural field boundaries are developed and evaluated. The different characteristics of field boundaries in remotely sensed images make it necessary to use several segmentation techniques in order to be able to detect the various boundaries. Therefore, an integrated method for agricultural field delineation is suggested. A multispectral edge and line detection method is presented and combined with multispectral unsupervised segmentation. Spectral similarity as well as shape properties are considered when merging over-segmented regions.

Site-specific spatial relations of growing conditions within a field are also investigated. Site-specific information is of interest for deciding management practices in precision agriculture.

Satellite images can be useful for investigating the possibility of site-specific crop management. However, the within-field variance makes automatic delineation of field boundaries difficult. The proposed method for boundary delineation detects

around 80% of the field boundaries in images from several sensors with different resolutions, which is good considering this is an automated method. Due to the fact that the accuracy is data dependent and that presentation of figures on accuracy for boundary delineation is rare in the literature, comparison to other methods is difficult. To be of real use in precision agriculture the accuracy on the boundary location has to be higher, but for per-field classification these boundaries are useful.

“Representing and analyzing 3D digital shape using distance information”

CBA, Uppsala
November 2001
Stina Svensson

The increase in number and decrease in cost for devices giving digital three-dimensional (3D) images have implied that the number of application areas where 3D images are used has increased lately. In fact, 3D images are important in many medical and industrial applications. Using a computer for analyzing images facilitates quantitative studies of image data. This is even more relevant when dealing with 3D images as they contain huge amounts of data and cannot be directly inspected by humans.

Many basic image analysis tools used for 2D images are not yet fully developed for 3D images. A goal would be to be able to use all methods introduced for 2D images also for 3D images. With this thesis, we want to fill part of this gap. We deal with algorithms used when the interesting part of the image, the object, has already been identified.

We present theoretical results on optimization done for computing distances in the image, giving results more stable under rotation without loss of computation simplicity. We also present various shape analysis methods using distance based algorithms. The shape analysis methods included are multiresolution representations of the object, where the object is represented by images at different resolutions, a decomposition scheme for the object, where the object is decomposed into simpler parts, and skeletonization of the object, where the object is represented by a structure of lower dimension.

Finally, distance based methods are applied to 3D images of paper. The aim is to have a deeper understanding of the 3D geometrical structure of the fibre network and of its effect on the optical and mechanical properties of paper.

“Atlas-based Fusion of medical brain images
methods and applications”

CBA, Uppsala

November 2001

Roger Lundqvist

This thesis focuses on the development of methods for fusion of information from medical brain scans. The concept of medical image fusion refers to the process of extracting and utilising information from several scans simultaneously in the analysis and diagnosis of patients. One very important part of the fusion process is the image registration, which is used to find a mapping or transformation of points from one image to the corresponding points in another image. This can, for example, be used to correct for relative movements between patient examinations, thus, making direct comparisons between different scans possible. Furthermore, the registration can be used to map images from different individuals into a common standard anatomy. This is important, since it enables comparisons between the individuals and also between whole groups of individuals. In the thesis, both methods to be used for registration between scans from the same individual and for scans from different individuals are presented.

Another part of the thesis is directed towards analysis of brain scans. Most of the methods are based on a computerised brain atlas, which defines a standardised mapping of the brain into subregions. These regions are either anatomical or functional and can be used for a more detailed analysis of the brain scan. The presented methods cover general methods for comparisons of single patients with groups of individuals, methods for feature calculations from brain atlas defined regions, and methods for extraction of more advanced features for automatic classification of brain scans.

Furthermore, image visualisation is always an important part in medical imaging. This is because the constantly increasing amount of medical information demands more advanced visualisation techniques to enhance and aid the interpretation of the data. The methods presented in this thesis are focused on combined visualisation of multiple brain

scans, which is useful when scans expressing different types of information are available. For instance, a combined visualisation can be helpful to detect anatomical regions of specific functional importance in the brain.

“Digital image analysis for wood fiber images”

CBA, Uppsala

December 2001

Mattias Moëll

The thesis contributes to the field of digital image analysis for applications where fibers in images of wood are analyzed.

Segmentation methods, i.e. the classification of a picture element (pixel) as either cell-wall or lumen, have been investigated. The accuracy of the segmentation process is crucial, since measurements are performed on the objects created by the segmentation. Thus, the better the cell wall classification is the higher the accuracy of the measurements becomes. For good contrast confocal microscopy images, automatic segmentation methods produced excellent results. Images of containing shading artifacts, due to inferior sample preparation, may in severe cases need shading correction to improve segmentation results. Different shading correction methods have been evaluated.

Different morphological characteristics of the wood fibers, which can be measured on cross-sections of wood, significantly affect the properties of wood products. An image analysis system has been developed to automatically measure radial, and tangential lumen diameter, and radial cell wall thickness. A comparison to manual measurements indicated stability and generality of the automatic image analysis method.

A rapid digital image analysis method for compression wood detection has also been implemented. Compression wood detection is of importance, since compression wood affects the overall quality of construction timber and paper quality. Although the method is species dependent, it is considered as a good supplement to wood grading criteria and to other compression wood detection methods.