

Hauptseminar/Master Seminar:

Machine Learning Methods for Computer Vision Applications

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Goals of the Seminar

Seminar Topic **Machine Learning and Computer Vision**

Learn how to:

- **Read** scientific papers.
- Research the **state of the art** on a specific topic.
- Write a scientific **report**.
- Do a scientific **presentation**.

Scientific Communication

- **During your studies:** Understand and discuss existing literature related to your own thesis (Bachelor's, Master's, Diploma).
- **Scientific publications (Conference / Journals / Workshops):**
 - Hundreds of conferences and journals on different topics
 - Present your own research and contribution to other researchers
 - Exchange of knowledge, make contacts
 - Confirmation and validation of contributions

Related Conferences / Journals

Conferences

- (CVPR) IEEE Computer Society Conference on Computer Vision and Pattern Recognition
- (ICCV) International Conference on Computer Vision
- (ECCV) European Conference on Computer Vision
- (NIPS) Neural Information Processing Systems
- (MICCAI) Medical Image Computing and Computer Assisted Interventions

Journals

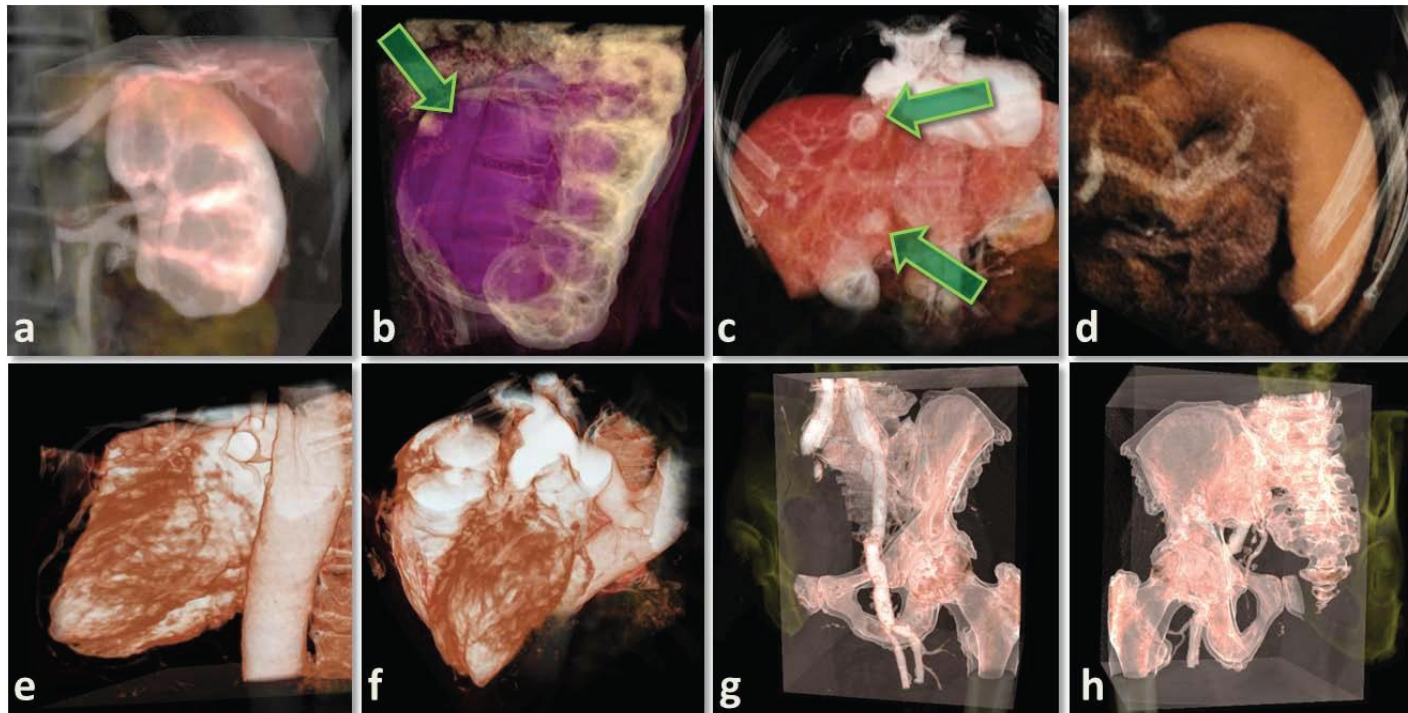
- (PAMI) IEEE Transactions on Pattern Analysis & Machine Intelligence
- (IJCV) Springer International Journal on Computer Vision
- (CVIU) Elsevier Computer Vision and Image Understanding
- (TMI) IEEE Transactions on Medical Imaging
- (MIA) Medical Image Analysis

Previous Years' Papers

Medical Image Analysis
Object Detection and Tracking
Image Analysis
Human Motion Analysis

Medical Image Analysis

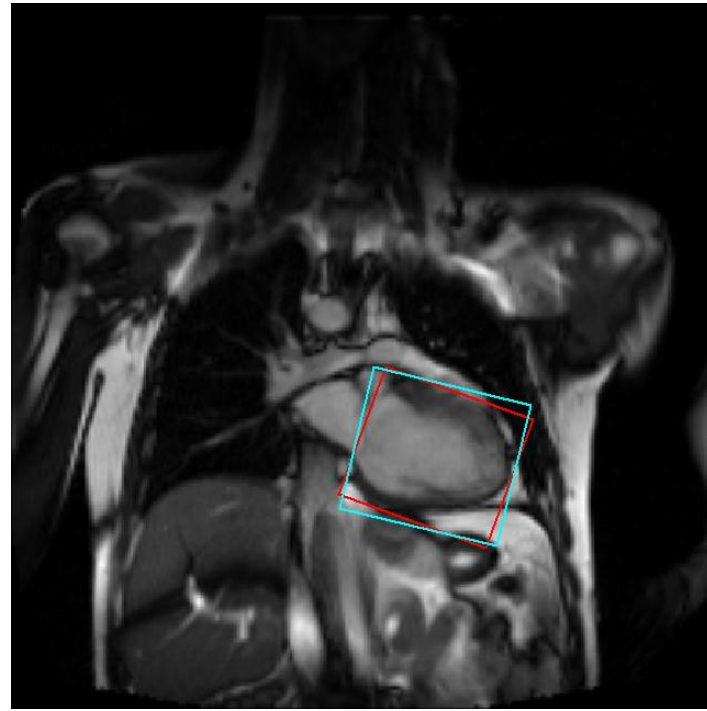
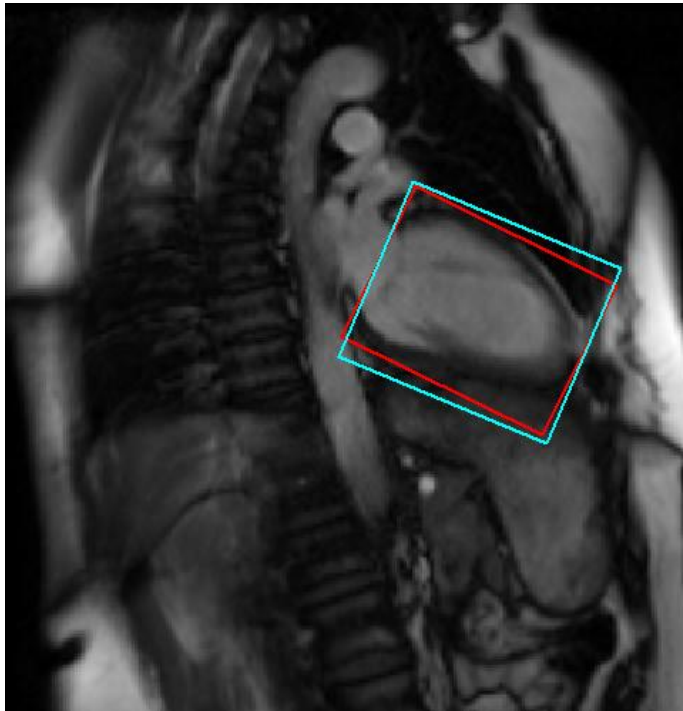
Organ Localization in CT scans using regression forests



Criminisi, Shotton et al.: **Regression Forests for Efficient Anatomy Detection and Localization in CT Studies**, MICCAI (2010)

Medical Image Analysis

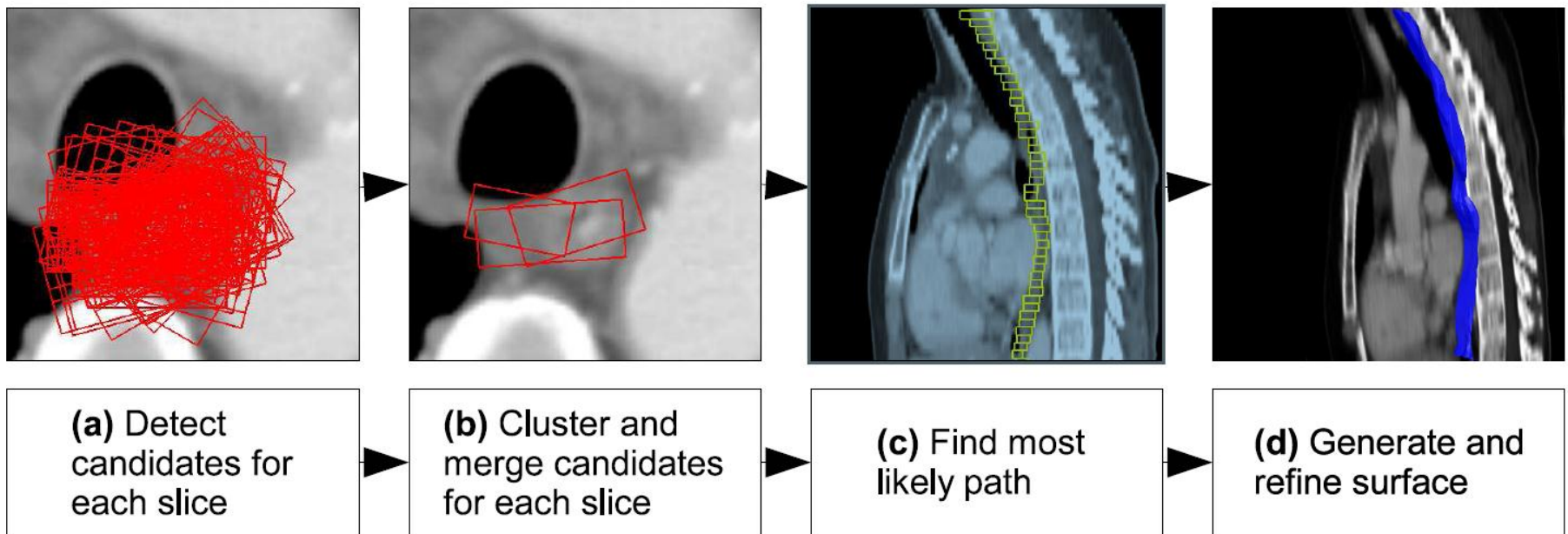
Organ Localization in CT/MR scans using Marginal Space Learning



Zheng, Georgescu et al.: **Marginal Space Learning for Efficient Detection of 2D/3D Anatomical Structures in Medical Images**, IPMI (2009)

Medical Image Analysis

Segmentation in CTscans using Marginal Space Learning



Feulner, Zhou et al.: **Fast Automatic Segmentation of the Esophagus from 3D CT Data Using a Probabilistic Model**, MICCAI (2009)

Object Detection and Tracking

Hough Forests

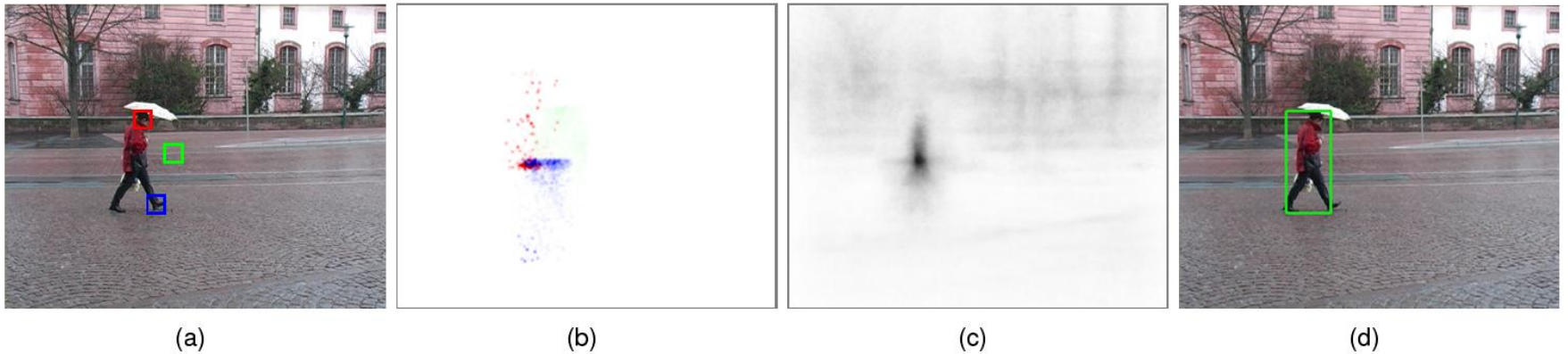
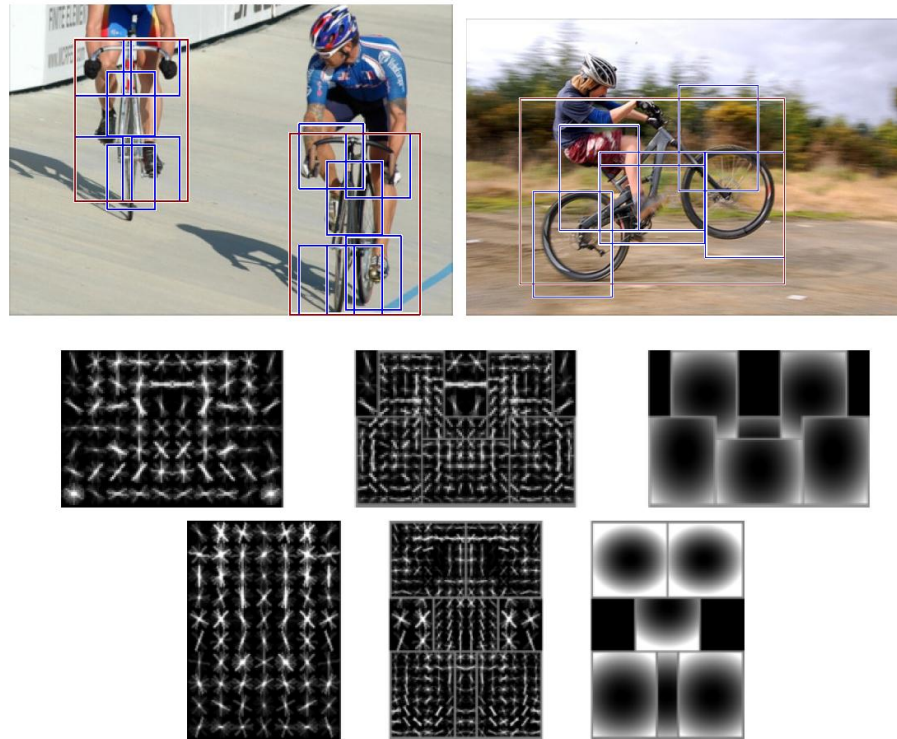


Fig. 1: For each of the three patches emphasized in (a), the pedestrian class-specific Hough forest casts weighted votes about the possible location of a pedestrian (b) (each color channel corresponds to the vote of a sample patch). Note the weakness of the vote from the background patch (green). After the votes from all patches are aggregated into a Hough space (c), the pedestrian can be detected (d) as a peak in this image.

Gall, Yao et al.: **Hough Forests for Object Detection, Tracking, and Action Recognition**, PAMI 2011

Object Detection and Tracking




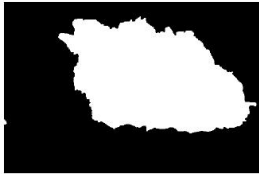
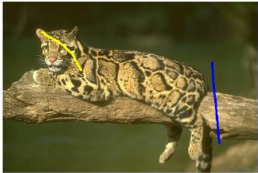

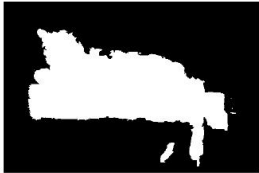





Part-based Object detection



Felzenszwalb, Girshick et al: **Object Detection with Discriminatively Trained Part Based Models**. PAMI (2010)

Image Analysis

Texture segmentation

Constraints	TVSeg	GrabCut	Our approach
	 90.0%	 73.8%	 94.6%
	 59.9%	 86.3%	 96.3%
	 99.4%	 89.4%	 99.6%

Santner, Unger et al.: **Interactive Texture Segmentation using Random Forests and Total Variation**, BMVC (2009)

Image Analysis

Super-resolution



(a) Bicubic

(b) Yang et al. [10]

(c) Proposed

Yang, Huang and Yang: **Exploiting Self-Similarities for Single Frame Super-Resolution**, ACCV (2010)

Human Motion Analysis

Human Pose Estimation using KINECT



Shotton, Fitzgibbon et al.: **Real-Time Human Pose Recognition in Parts from Single Depth Images**, CVPR (2011)

Human Motion Analysis

Human Pose Estimation / Action Recognition



(a) Silhouette

(b) Action Recognition

(c) Pose Distribution

(d) Final Pose

Gall, Yao and van Gool: **2D Action Recognition Serves 3D Human Pose Estimation**, ECCV (2010)

This year's topics

Presentation Topics

Please choose one of the following papers for your seminar presentation. For obtaining the full-text PDFs, please use Google and especially Google Scholar. In case you are interested in a paper but cannot find the full text, please e-mail us.

Please send a mail to Olivier Pauly (pauly@in.tum.de) as soon as possible with your preferred topic.

Medical Image Analysis

- **(taken)** Lee, Hofmann et al.: Learning Similarity Measure for Multi-Modal 3D Image Registration, CVPR (2009)
- Lucchi, Smith et al.: Supervoxel-Based Segmentation of Mitochondria in EM Image Stacks with Learned Shape Features, TMI (2011)
- Geremia, Clatz et al.: Spatial Decision Forests for MS Lesion Segmentation in Multi-Channel Magnetic Resonance, Neuroimage (2011)
- **(taken)** Huh, Ker, Bise et al.: Automated Mitosis Detection of Stem Cell Populations in Phase-Contrast Microscopy Images, IEEE TMI (2011)
- **(taken)** Zheng, Barbu, Georgescu et al.: Four-Chamber Heart Modeling and Automatic Segmentation for 3D Cardiac CT Volumes using Marginal Space Learning and Steerable Features, IEEE TMI (2008)
- **(taken)** Montillo, Shotton et al.: Entangled Decision Forests and their Application for Semantic Segmentation of CT Images, IPMI (2011)
- Iglesias, Konukoglu et al.: Combining Generative and Discriminative Models for Semantic Segmentation of CT Scans via Active learning, IPMI (2011)
- **(taken)** Turetken, Blum et al.: Reconstructing Geometrically Consistent Tree Structures from Noisy Images, MICCAI (2010)
- **(taken)** Smith, Carleton et al.: Fast Ray Features for Learning Irregular Shapes, ICCV (2009)
- **(taken)** Kohlberger, Zhang et al.: Automatic Multi-Organ Segmentation Using Learning-based Segmentation and Level Set Optimization, MICCAI (2011)

Dimensionality Reduction

- **(taken)** Carreira-Perpiñán and Lu: Parametric Dimensionality Reduction by Unsupervised Regression, CVPR (2010)

Image Analysis

- **(taken)** Kim, Lee and Lee: Learning Full Pairwise Affinities for Spectral Segmentation, CVPR (2010)
- **(taken)** Alzate and Suykens: Multiway spectral clustering with out-of-sample extensions through weighted kernel PCA, PAMI (2010)

Human Motion Analysis

- Jiang: Human Pose Estimation Using Consistent Max-Covering, ICCV (2009)
- **(taken)** Darby, Li and Costen: Tracking human pose with multiple activity models, Pattern Recognition (2010)
- Li, Fermuller et al.: Learning Shift-Invariant Sparse Representation of Actions CVPR (2010)
- Urtasun, Fleet, Hertzmann and Fua: Priors for People Tracking from Small Training Sets, ICCV (2005)
- **(taken)** Tian, Li and Sclaroff: Articulated Pose Estimation in a Learned Smooth Space of Feasible Solutions, CVPR (2005)
- Sigal, Black et al.: Loose-limbed People: Estimating Human Pose and Motion using Non-parametric Belief Propagation, IJCV
- **(taken)** Freifeld, Weiss et al.: Contour people: A parameterized model of 2D articulated human shape, CVPR (2010)
- **(taken)** Eichner, Marin-Jimenez et al.: Articulated Human Pose Estimation and Search in (Almost) Unconstrained Still Images, ETH Zurich (2010)
- **(taken)** Nowozin, Rother et al.: Decision Tree Fields, ICCV (2011)
- **(taken)** Girschik, Shotton et al.: Efficient Regression of General-Activity Human Poses from Depth Images, ICCV (2011)
- **(taken)** Kotschieder, Rota Buló et al.: Structured Class-Labels in Random Forests for Image Labelling, ICCV (2011)

In Practice...

Reading the paper
Presentation
Report

The Seminar in Practice....

- **SWS: 2+0 ECTS: 4 Credits. Course Language: English**
- ~ 2-3 presentations per session.
- **Presentation: 20 min presentation / 10 min questions.** Download the template from the seminar webpage.
- Write a **report (max 8 pages)**. Download the template from the seminar webpage.
- **Attendance** and participation of the seminar meetings
 - Participation: read the abstract, see figures, read introduction and conclusions.
 - **Prepare questions.**

The Seminar in Practice....

① Prepare



- Read, read and read.....
- Prepare the **presentation** and **report**.

② 2 weeks before



- Fix a meeting (send a mail to your supervisor)

③ 1 week before



- Discuss the report and presentation with your supervisor

④ Presentation



- + questions, exchange of ideas, feedback.

⑤ 1 week after



- Send the final report

Contents of the Presentation

As a rule of thumb: max 1 slide per minute (max 20 slides for 20 mins)

- **Present the paper**
 - Type and year of publication: journal, conference, workshop, etc.
 - Authors/Institution
- **Motivation and Goal**
 - What is the problem that the authors try to solve?
 - Name potential applications: what for?
 - General motivation: why is it interesting?
- **Related Work (state of the art)**
 - Mention most similar approaches and explain how your paper is different from them?
 - **Citing/Referencing other people's work [Lastname-Conference-Year].**
- **Method**
 - **Overview (1 or 2 slides): input, output, contribution (the proposed new elements)**
 - Method/Algorithm (Only key ideas).
- **Results (short version)**
 - Explain the type of **data** used.
 - Validation: what is being validated and how.
- **Conclusion (include your own conclusions)**

Related Work: Access to Scientific Publications

- Access to the most publications is not free
- Many publications can be accessed for free using the TUM-proxy
- Some places to look for publications:
 - **Google Scholar** <http://scholar.google.de>
 - **Citeseer** <http://citeseer.ist.psu.edu/>
 - **Our library**
 - Books and electronic media...
 - Link to instructions how to access/download electronic media:
<http://www.biblio.tu-muenchen.de/medien/emedien.html>
 - Link to access/download media outside of the campus:
<http://www.lrz-muenchen.de/services/netzdienste/proxy/documentweb/>

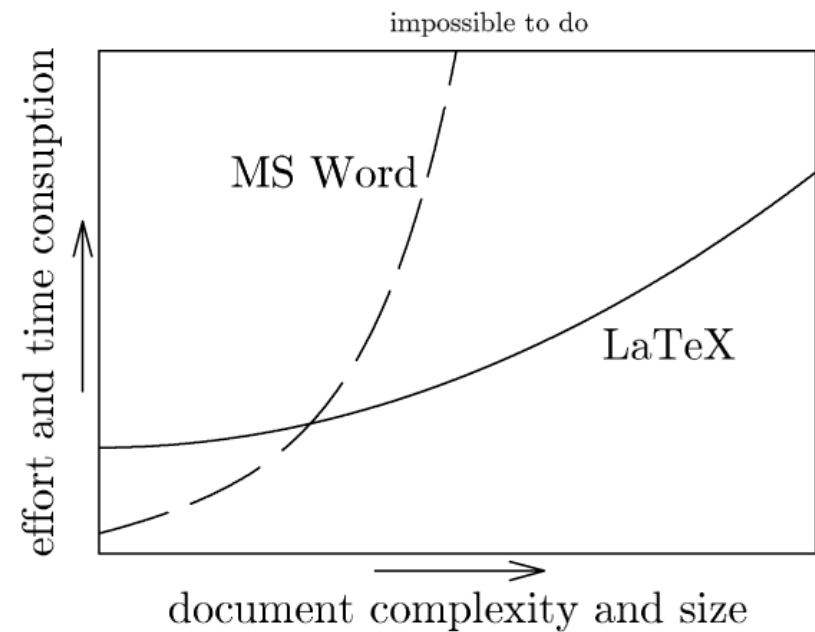
Contents of the Report (Max 8 pages)

Follow the structure of a scientific publication.

- **Abstract and Introduction (~1 page)**
 - General motivation.
- **State of the Art and Contributions (~2 pages)**
 - **Look for related papers, books, websites, videos etc.** e.g. Papers citing the studied work.
 - How is this paper different from (SoA)? e.g. What is new? What is better? What is faster?
- **Problem statement (~1 page)**
 - Mathematical formulation
- **Method (~2 pages)**
 - Overview: input, output.
 - Method/Algorithm.
- **Results (~1 page)**
 - Summary of experiments and results (what type of data and validation).
 - **YOUR CRITIQUE** of the methodology, set-up and validation (what else could have been done?, is it enough to demonstrate the contribution?, is the data biased?, are there non mentioned assumptions?, can it be easily reproduced?)
- **Conclusion (~1 page)**
 - **YOUR PERSONAL CONCLUSION & IDEAS**
- **References (~1 page)**

Instructions for the Report

- **Do NOT copy and paste, not even a single phrase**
- Use the LATEX template that is on the seminar webpage.
- Available free for Windows, Linux and Mac OS
- Download and install LaTeX distribution
 - Windows: MikTeX
 - Mac: MacTeX
- Download and install LaTeX editor
 - TeXicCenter, TexMaker, TexShop



[Marko Pinteric]

Evaluation Criteria

- Presentation (50%)
 - Understanding (Prepare in advance!)
 - Quality of slides/material
 - Clarity of motivation
 - Clarity of method overview, add **intuitive** explanations
 - Appropriate use of formulas
 - Personal conclusion
- Report (50%)
 - USE OF **OWN** WORDS
 - Presentation, language and structure
 - **State of the art**
 - Personal conclusion

Finally

- Seminar groups are usually heterogeneous.
So it is normal if you do not understand the details of each presentation.
- **DO ASK questions** about what is not clear.
This will not penalize the presenter, they will give you **participation points** and everybody might learn something from it.
- For detailed **feedback** after your presentation come to our office.
- The duration of the presentation is **20 min** (strictly).
We will ask you to jump to your conclusions if the indicated duration is exceeded.

Dates

- Paper list is online
<http://campar.in.tum.de/Chair/TeachingSoSe2012MLCVSeminar>
- Presentation dates will be in
 - 5 blocks of around 2 hours
 - 19th June – 17th July
 - Tuesdays between 13.00 – 15.00/15.30
 - Detailed schedule will be announced soon