Mission Statement

When I had the chance to try Tesla's autopilot, I was more than enthusiastic. After all, I studied computer vision for nearly two years to understand how difficult autonomous driving is and what state-of-the-art techniques can achieve. However, on the busy highways around Frankfurt am Main, the autopilot was barely able to be active for a minute without human intervention.

This experience motivated me to work towards a fully autonomous car — a car that can truly navigate through... say Aachen's historic center on a rainy but crowded Friday night. I think autonomous driving is an important next step that will have tremendous impact on how we perceive and use intelligent machines that have considerable responsibilities.

I am confident that I can truly contribute to the field of autonomous driving through original research in computer vision. In the future, I want to play an important role in making fully autonomous cars reality both regarding the technical aspects as well as the necessary public discussion. I identified a PhD as the ideal framework to become a thought leader in computer vision by devoting my full attention to research.

Background

At RWTH Aachen University, through seminars on neural networks and deep learning (see [1]) as well as two teaching opportunities in mathematics, I got introduced to the academic world and began considering a PhD as challenging opportunity after graduation.

Advised by Prof. Bastian Leibe, I wrote my bachelor thesis on "Superpixel Segmentation using Depth Information" [2]. Parts of the results were published at the German Conference on Pattern Recognition (GCPR) 2015 as student paper [3]. In addition, a journal paper providing a comprehensive comparison of available superpixel algorithms [4] is in preparation. Both publications spurred my ambition to practice computer vision research on a full-time basis and equipped me with valuable skills including academic writing and reproducible research. Above all, this experience taught me perseverance regarding my research goals and interests.

An exchange semester at the Georgia Institute of Technology further strengthened the idea of pursuing a PhD in computer vision. Thanks to Prof. Bastian Leibe, I was welcomed in Prof. Irfan Essa's group and worked side-by-side with his PhD students. Addressing video segmentation and intrinsic images/video, I was able to devote more time to research than before. This experience not only benefited my intercultural skills, but also contributed to my understanding of original research. I learned to question my beliefs of what is possible and to value one-to-one advising in the academic environment.

In industry, two experiences are particularly related to my career goals. First, I worked with Dr. Stefan Holzer and Dr. Alexander Trevor at Fyusion on computer vision problems including line segment and keypoint tracking, statistical clustering and pedestrian detection. Second, supervised by Dr. Thomas Guthier from MOBIS, I was introduced to advanced driver assistance systems working on deep learning for pedestrian detection. Based on the exchange of experiences, I started to recognize the value of a PhD as opportunity to immerse myself deep into challenging topics. Moreover, I became fascinated by autonomous driving, especially going beyond pure (pedestrian) detection and towards scene understanding.

Research Interests

Urban scene understanding for autonomous driving is a challenging task both due to the complexity of real world traffic scenes and the strict requirements regarding safety and reliability. Recent advances in deep learning have already had major impact on tasks such as object detection or semantic segmentation. However, as indicated by Prof. Amnon Shashua [5], scene understanding

for autonomous driving involves additional semantic layers beyond these individual tasks. For example, going from free space, lane markings and pedestrian/vehicle detection to drivable paths through complex traffic situations.

Scene understanding for autonomous driving has been tackled in the past, especially by Dr. Andreas Geiger [6]. I would like to leverage deep models with end-to-end training to revisit the problem. In contrast to Prof. Amnon Shashua's believe [5], I am convinced that jointly learning similar tasks in an end-to-end fashion is beneficial to leverage context. Based on the (possibly limited) overview as student, I believe that this approach to scene understanding is both promising and considerably new.

Max Planck ETH Center for Learning Systems

The contact to researchers from the MPI in Tübingen had significant influence on my decision to specifically apply for this PhD program. During my exchange semester, I got to know Prof. Michael Black and Dr. Naejin Kong as part of a short collaboration. Later, talking to Dr. Peter Gehler gave me further, valuable insights regarding PhD program structure, work environment and international orientation. Finally, since January, I have been in contact with Dr. Andreas Geiger regarding the possibility of completing my master thesis at the MPI in Tübingen. His work and guidance has considerable influence on my research interests and career goals. Altogether, I determined the MPI in Tübingen as perfect fit for my PhD studies.

The research impact of ETH Zürich is well-known to students seriously considering computer vision. I first realized this through Prof. Bastian Leibe's research and, thereupon, frequently used datasets and publications from ETH Zürich as basis for my work – both in academia and industry. Above all, ETH Zürich perfectly complements my personal expectations regarding a PhD through the possiblity of international, cross-institutional exchange and collaboration – which I consider vital for personal and professional growth.

Next Steps

Beginning in January, I will write my master thesis in Dr. Andreas Geiger's group. With his guidance, I am currently identifying topics appropriate for the limited time and matching my research interests. I intend to use the thesis to narrow down my research interests and provide a solid basis for a strong, first publication. Possible topics include 3D convolutional networks, adversarial generative networks and deep structured models applied to scene understanding in autonomous driving.

Conclusion

In conclusion, I am motivated to begin my career with a PhD at the Max Planck ETH Center for Learning Systems. Equipped with a unique mindset and valuable skills from industry and academia, I want to shape the impact of deep learning on scene understanding for autonomous driving by collaborating with world leading researchers and like-minded students.

References

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