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Invented for life

Semester project proposals

- Perception for automated driving -

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Automated driving perception – project proposals

1- Semantic boundaries detection

- **Why?**
  - Compact (embedded friendly) representation of semantic segmentation based perception outputs
  - Precision of the boundaries leading to increased perception performance
- **References**
  - Paper & code: https://github.com/nv-tlabs/STEAL
  - CASENet: https://paperswithcode.com/paper/casenet-deep-category-aware-semantic-edge#code
- **Remarks**
  - Potential to be used for subset of sematic classes (e.g. road boundaries for free-space, curbstones to complement lane detection, etc…). Potential for application in other domains.

Acuna, David, Amlan Kar, and Sanja Fidler. "Devil is in the edges: **Learning semantic boundaries** from noisy annotations." *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*. 2019.

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2- Semantic line segments detection

- **Why?**
  - Detect semantic edges for trees, buildings, poles, infrastructure elements in general
- **References**
  - Paper & code: https://github.com/SunLoveSheep/Sem-LSD
- **Remarks**
  - See also: https://github.com/cvg/DeepLSD
  - More papers with code here: https://paperswithcode.com/task/line-segment-detection

Sun, Yi, et al. "Sem-LSD: A learning-based **semantic line segment** detector." *arXiv preprint arXiv:1909.06591* (2019).

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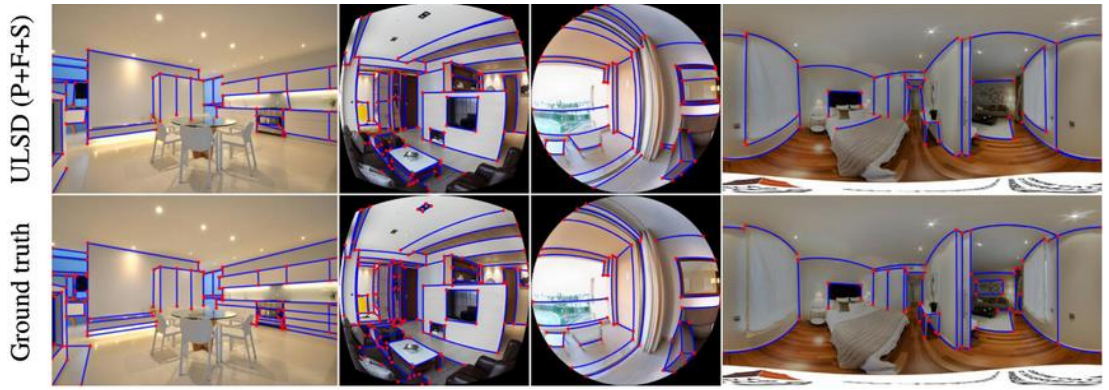
3- Unified line segments detection

- **Why?**
  - Straight lines detection in distorted images (can be used for parking slots detection, camera auto-calibratio etc..)
  - Independence of lens distortions (e.g. works with fisheye and spherical cameras)
- **References**
  - Project page: https://nv-tlabs.github.io/STEAL/
  - Paper & code: https://github.com/lh9171338/ULSD-ISPRS
- **Remarks**
  - General DL-based detector for straight line segments and junctions detection



Hao Li, Huai Yu, Jinwang Wang, Wen Yang, Lei Yu, Sebastian Scherer, ULSD: **Unified line segment detection across pinhole, fisheye, and spherical cameras**, ISPRS Journal of Photogrammetry and Remote Sensing, Volume 178, 2021, Pages 187-202

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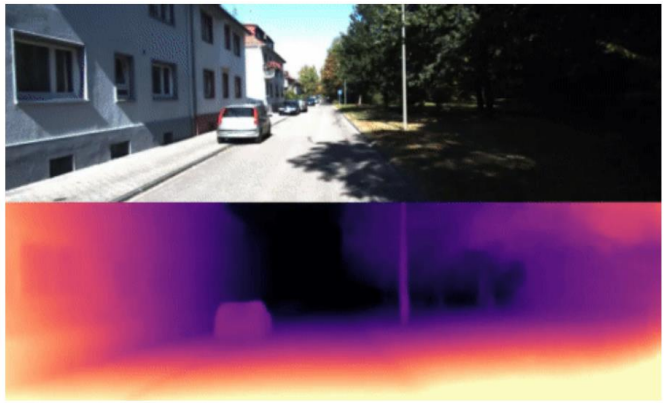
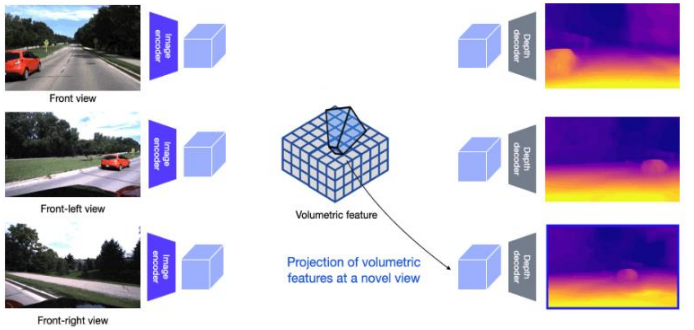
4- Monocular depth estimation

- **Why?**
  - 3D perception from self-driving vehicles
- **References**
  - Paper & code:
    - https://paperswithcode.com/paper/digging-into-self-supervised-monocular-depth-1#code
    - https://github.com/nianticlabs/monodepth2
    - https://github.com/bolianchen/monodepth2_on_nuscenes_cityscapes
- **Remarks**
  - There are multi-view approaches in the recent research landscape that can be used alternatively as starting point
    - https://github.com/zxcqlf/monovit
    - https://github.com/42dot/VFDepth



Godard, Clément, et al. "Digging into **self-supervised monocular depth estimation**." *Proceedings of the IEEE/CVF international conference on computer vision*. 2019.



Kim, Jung-Hee, et al. "Self-supervised **surround-view depth estimation with volumetric feature fusion**." Advances in Neural Information Processing Systems 35 (2022): 4032-4045.

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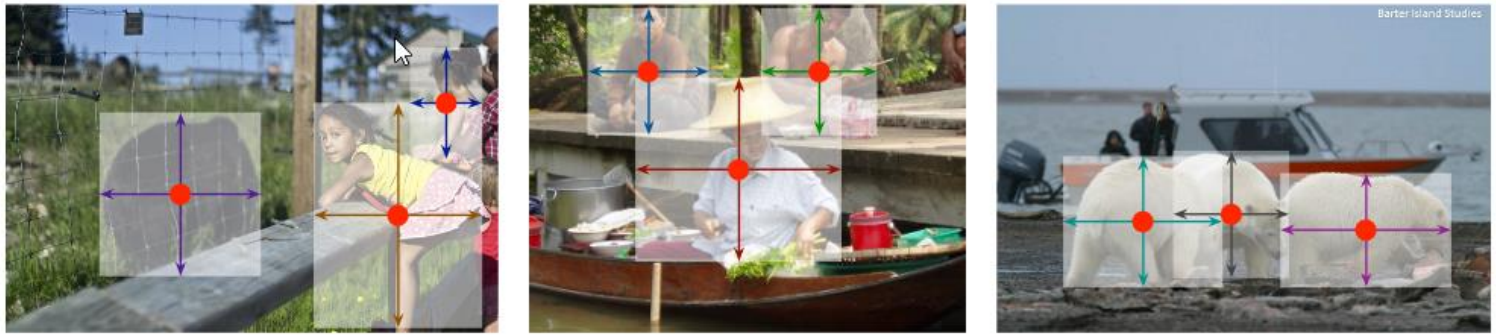
5- Objects detection

- **Why?**
  - Key enabler for automated driving
  - Detection of road signs, traffic lights, vehicles, pedestrians, cyclists painted symbols etc..
- **References**
  - **YOLO**: https://github.com/meituan/yolov6
  - **CenterNet** is a promising alternative approach: https://github.com/xingyizhou/CenterNet
- **Remarks**
  - More relevant academic papers & code: https://paperswithcode.com/task/real-time-object-detection



CenterNet

Zhou, Xingyi, Dequan Wang, and Philipp Krähenbühl. "**Objects as points**." *arXiv preprint arXiv:1904.07850* (2019).

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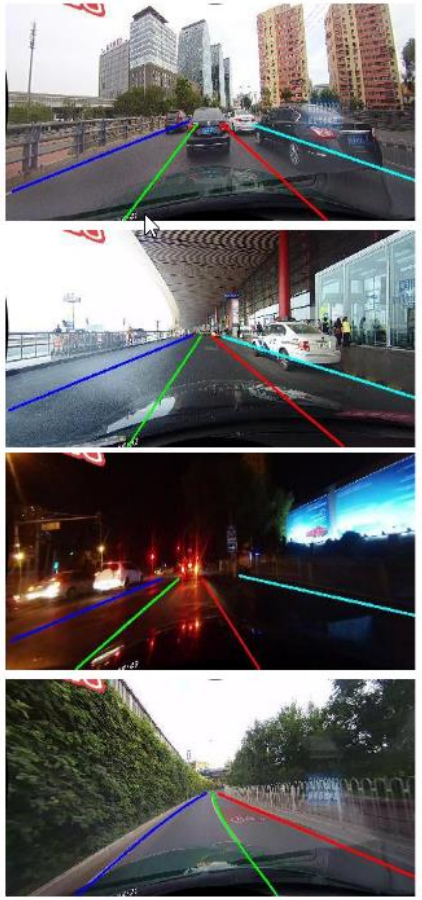
6- Lane detection

- **Why?**
  - Key enabler for automated driving
  - Functions: lane departure warning, lane keeping support, integrated cruise assist etc..
- **References**
  - CLRNet: https://github.com/Turoad/clrnet
  - Key-points based approach is also promising: https://github.com/koyeongmin/PINet_new
- **Remarks**
  - 3D lane detection as extended objective:
    - https://paperswithcode.com/task/3d-lane-detection
    - https://github.com/OpenDriveLab/OpenLane



Zheng, Tu, et al. "Clrnet: Cross layer refinement network for **lane detection.**" Proceedings of the IEEE/CVF conference on computer vision and pattern recognition. 2022.

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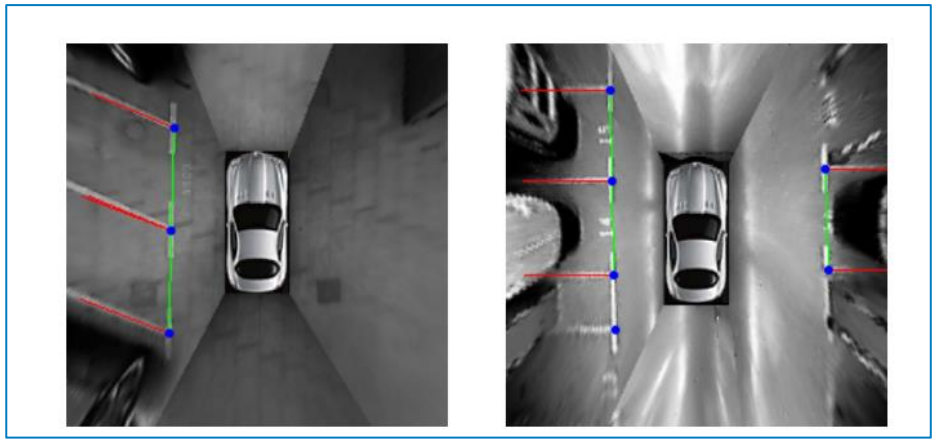
7- Parking slots detection

- **Why?**
  - Smart city applications (e.g. automatic identification of free parking spots)
  - Parking assistance functions (e.g. automatic parking)

- **References**
  - Paper & code: https://github.com/tjiiv-cprg/SPFCN-ParkingSlotDetection
  - Data set: https://cslinzhang.github.io/deepps/

- **Remarks**
  - Car be used on surround view cameras or on inverse perspective mapping representation (IPM)
  - Reference for IPM: https://towardsdatascience.com/a-hands-on-application-of-homography-ipm-18d9e47c152f



Yu, Zhuoping, et al. "SPFCN: select and prune the fully convolutional networks for **real-time parking slot detection**." *2020 IEEE Intelligent Vehicles Symposium (IV)*. IEEE, 2020.

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Thank you!!!
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Automated Driving
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