Real-Time Object Detection and Semantic Segmentation

Wei Li
Corporate Development manager

Geetank Raipuria
Computer Vision Engineer

NavInfo Europe

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NavInfo - our growth benefits from AI

Map & Navigation Provider
- Surveying and Mapping Knowledge
- Image processing

Smart Mobility Provider
AI developed by us provides:
- Perception for our autonomous solutions
- Can also benefit & apply to other industries
- Support related companies/partners, like NVIDIA
NavInfo’s business growth path

- **2002**: 1st Obtained Government License
- **2004**: 1st R&D Navigation Map
- **2006**: 1st Commercial Navigation Map
- **2007**: 1st On Mobile Devices & Internet
- **2009**: 1st Pedestrian Navigation Map
- **2010**: 1st ADAS Map of China to BMW
- **2011**: Tencent New Shareholder
- **2012**: 1st Commercial Navigation Map on Mobile Devices & Internet
- **2014**: 1st Commercial NDS Map Product to Market
- **2015**: Expand the HD Map development
- **2016**: Advanced ADAS Map of China to BMW, Daimler & VW
- **2018**: More HAD map solutions
- **2019**: Working with more OEM autonomous solutions
- **2021**: BMW L3 car applies NavInfo HD Map in China

- JV’s with NAVTEQ & TOYOTA Tsusho
- 1st Commercial Dynamic Traffic Information
- 1st Navi Data Supplier on SZ Stock Exchange
- Provide NVIDIA HAD map for its localization service
- Provide Autonomous driving solution to several Chinese OEMs
- Provide Autopilot solution based on our own localization product
NavInfo’s Footprint

America
• International Business Expansion

Netherlands
1) NavInfo EU
• Advanced AI Research Lab
• EU Business Expansion
2) AIIM
• Autonomous driving & Robotics solution provider
3) Mapscape

China
• 21 Localization Bases for Data Collection and Technology Services
• 6 R&D Centers (Shanghai, Xi’an, Shenyang, Wuhan, Hefei, Shenzhen)
• Beijing Headquarters

Singapore
• Southeast Asia Business Expansion
Cooperation between NavInfo & NVIDIA

NavInfo’s Perception Technology
NavInfo’s research lab developed a vision based system that can detect and classify objects in real time on NVIDIA Xavier.

NavInfo’s Training Model
NavInfo trains and optimizes its models on NVIDIA DGX-1 servers.

Artificial Intelligence

NVIDIA’s new system - DRIVE Localization
NVIDIA DRIVE Software use NavInfo’s HD Map to give customer a way of localizing their autonomous driving car.

We support and benefit each other’s achievements, driven by AI, to generate better products and services to our customers and end users.
NavInfo Service Offerings in Europe

Autonomous driving and robotic solutions

AI based solutions for different industries

AI based algorithms
Results from TU/e sponsored by NavInfo Europe

No. 4 in the world in the Semantic Segmentation
Deep Learning for HD Mapping
Includes highly accurate lane and road features.
Deep Learning for HD Mapping Feature Extraction

- Deep learning provides automating feature extraction from video feed of collection vehicles
Real Time Object Detection

Geetank Raipuria  
Computer Vision Engineer  
Advanced Research Lab  
NavInfo Europe

Andrei Pata  
Software Engineer  
Advanced Research Lab  
NavInfo Europe
**Real-Time Object Detection System**

Object Detector based on Deep Convolutional Neural Network architecture, to localize and classify road signs and traffic lights from a real-time camera feed.

**Two Stage System: Best of both worlds**
- High Accuracy
- Low Inference time
Real-Time Object Detection System

**Features Supported**

*350+ supported classes including*

Traffic Signs
- Regulatory Signs
- Warning Signs
- Guide Signs
- Information Signs
- Road Work Signs

Signboards

Traffic Lights

Digital Traffic Signs

**Real Time Performance**

2-3x Speedup using Tensor RT

About: **35 fps** on INT8 on NVIDIA Xavier SoC

: **110 fps** on Titan XP

Inference at Full HD resolution (1920x1080)

**Able to extract and classify object as small as 25x25 pixels**

**Robust to extreme lighting conditions**
Sample Detections
Sample Detections
Advanced Research Lab/NIEU focuses on the development of the AI algorithm, the data processing is done completely in China. We comply with all Chinese regulations regarding the processing of China data.
Real Time Semantic Segmentation

Ahmed Badar
Computer Vision Engineer
Advanced Research Lab
NavInfo Europe

Matti Jukola
Software Engineer
Advanced Research Lab
NavInfo Europe
Deep learning architecture to segment and extract road markings at pixel level

**Real-Time Semantic Segmentation**

Camera input → Segmentation Network → Segmented road markings

- Fully Convolutional Neural Network
Real-Time Semantic Segmentation

Our model is based on a multi-branch convolutional neural network architecture.
Real-Time Semantic Segmentation

Currently supports 40 Road Marking Classes, including:

- Lane lines
- Arrows
- Text

Real Time Performance

3x Speedup using Tensor RT

- About: 90 fps on NVIDIA Xavier SoC
- 300 fps on Titan XP

Inference at 1024 × 384 image sizes

This includes image transformations (top and front view)
Sample Segmentations

Input Image | Ground Truth | Prediction
Sample Segmentations

Input Image | Ground Truth | Prediction
Demo Realtime Semantic Segmentation

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Online video available at https://youtu.be/E4hU-COkHDo
Real Time Scene Understanding

Elahe Arani
Senior AI Researcher
Advanced Research Lab
NavInfo Europe

Mahmoud Gamal
Computer Vision Engineer
Advanced Research Lab
NavInfo Europe
Real-Time Scene Understanding

A real time *unified* object detection and semantic segmentation for autonomous driving cars/HD mapping.
Joint Object Detection and Segmentation

Currently supports **40** Road Marking Classes and **350+** Road Sign classes including:

- Traffic Signs
- Gantry Signboards
- Traffic Lights
- Digital Traffic Signs
- Lane Markings
- Text
- Arrows

**Performance**
Inference at 512x512 image sizes
About **45 FPS** on Titan XP

**Other Features Supported**
- Guard Rails
- Curbs
- Speed Limits on Road
Sample Detections
Sample Segmentation

Input Image

Ground Truth

Prediction
Joint Detections and Segmentation

Prediction (Dec)            Ground Truth            Prediction (Seg)
Occlusion Handling

Input Image  Prediction (Dec)  Ground Truth  Prediction (Seg)
Occlusion Handling

Input Image  |  Prediction (Dec)  |  Ground Truth  |  Prediction (Seg)
Demo Realtime Scene Understanding

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Online video available at https://youtu.be/NJVNFfueKb4