

# **Safety Assessment of Camera Detection and Classification Systems Used in Autonomous Driving**

**Paul Liu**

Samsung Strategy and Innovation Center  
Samsung Electronics  
San Jose, CA 95134, USA  
[paul.marc.liu@gmail.com](mailto:paul.marc.liu@gmail.com)

## **Abstract**

During the past five years there has been many advances in sensor and compute technology that have made the development of Autonomous driving systems possible. Typical sensors driving the autonomous system perception system include cameras, LIDARs, ultrasonic sensors, and radars. Owing to relatively low cost, camera systems have been the preferred sensor for any automated systems. Perception and classification algorithms based on Machine Learning and Deep Learning have shown increasing accuracy and ability to detect and classify objects. Unfortunately since Machine Learning and Deep Learning algorithms mimic the human learning and execution capabilities, it is still not possible to achieve 100% accuracy. One of the goals of autonomous driving is to achieve and deliver greater safety systems around on-road vehicles. Recent updates to the automotive functional safety standard, the ISO 26262-2018 describe the safety mechanism to be used for such camera based perception system under the umbrella of Safety of the Intended Functionality (SOTIF). This paper will attempt to decompose an autonomous system camera based system into its various components, analyze the various sources of errors using FMEA, FMEDA, develop diagnostic coverage counter-measures to decrease residual errors, and provide an initial safety assessment of the prototype.

## **Keywords (12 font)**

ISO-26262, SOTIF, Machine Learning, Deep Learning, Functional Safety

## **Page Layout**

- 8 1/2" X 11" paper size
- All margins: 1.00"
- Full justification
- Times New Roman font

Do not include page numbers.

Manuscript must be in MS Word.

## **Acknowledgements**

Add acknowledgement if need

## **Biographies**

**Paul Liu** joined Samsung Strategy and Innovation Center after 24 years in both the semiconductor and transportation industries, and is currently developing products to support autonomous vehicle functionality. He has published papers and made presentations at the SAE World Congress and at other events and in industry publications.

Paul owns a commercial nut farm, where he tests his development of autonomous farming equipment. He also mentors robotics and statistics students in Middle and High School.

As well as being a member of the Society of Automotive Engineers, Project Management Institute, and the Association of Professional Engineers of British Columbia, Paul holds a BA Sc. in Electrical Engineering from the University of British Columbia and an Executive MBA from Simon Fraser University.