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Project manager: Stefan Johansson

Night Vision Animal Detection for Active Safety

The project Night Vision animal detection for active safety has developed a concept for animal detection during night time driving, using a far infra-red sensor. To be able to do this a concept has been developed to generate simulated reference data for algorithm development. This has resulted in a demonstrator implementation installed in a vehicle.

Objective

The primary objective is to develop an animal detection function for a night vision system that can detect deer animals (deer, roe deer, moose, etc.) The function shall primarily detect animals of the deer family, which are involved in more than 90% of all animal accidents in Sweden and Germany. When animals are detected the driver shall be warned to be able to avoid a potential accident.

The secondary objective is to develop a concept for generating simulated reference data for algorithm development; this is done to enable the development of the main function.

Results and deliverables

A concept for animal detection has been developed. The basic steps of this concept have also been implemented as a prototype and been installed in a vehicle. The concept shows a good detection capability, however, the false detection rate is somewhat too high.

A concept for generating data for algorithm development has been developed together with a tool to generate data. The concept has been verified against reference data to verify the thermal simulation as well as in the algorithm development to verify that the generated data is relevant compared to real data.

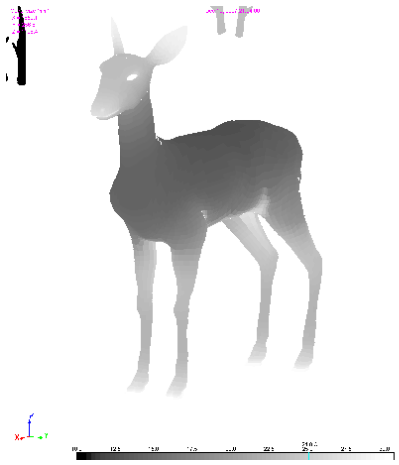
The use of generated data has a positive contribution to the detection result, but generated data cannot replace real data entirely. Mainly because the animal models do not cover all type of motions an animal can perform and poses. Generated data contributes the most in situations where real scenarios are difficult to find.

Project realization

The project has been divided into three different work packages, data generation, animal detection, and, reference data collection.

Data Generation

To be able to get representative data in an easy and cost efficient way, a concept has been developed to generate artificial animal data for a far IR-sensor. The concept is based on using 3D animal models and adding both animation and IR signatures for the animals. By using these models, sequences are generated that can be used for development of the animal detection algorithms. The image below shows a roe deer simulated for an IR-sensor. To simulate realistic data other effects have been accounted for, such as sensor properties, weather, and, animal variations.



The image shows a thermally simulated roe deer.

To verify the thermal simulations, reference data from a radiometric calibrated sensor has been used. The reference data has been collected during varying weather and seasons. The reference data does not cover all animals and temperature variations, but with knowledge from temperature regions where reference data are available, animal anatomy and other known physical properties, the models have been extrapolated to all specified temperature ranges.

Animal Detection

Several different classification methods have been developed and refined during the project. These have been compared based on detection performance, but also heavily on calculation complexity. For these types of functions it is important with a low calculation complexity since the target hardware has limited computational resources.

To evaluate if the detection performance becomes better a database has been established with animal reference markings. New algorithm ideas are evaluated on the database to see if the contribute positively to the function. To be able to do this efficiently, a tool chain has been constructed that automates the evaluation as much as possible.

In a similar fashion also a method to detect rural driving environment has been developed and evaluated.

Reference Data Collection

To collect reference data a sensor has been mounted in a vehicle together with a PC that records the sensor data. At night time, the vehicle has been driven on roads where wild animas are known to appear frequently and the recording is triggered manually when an animal is seen.

Mostly animals in traffic environment has been recorded and marked with reference labels to be used for both development and verification. Additionally, reference data has been collected using a special sensor to get reference data for the simulation concept. These recordings have been done in deer parks and zoos.

Project outcomes

The results in this project will lead to further development of the function within Autoliv, to be able to introduce this function on the market. The simulation concept will be used within Autoliv in the future for the further development of the function. In addition, several of the project results for the simulation concept will be used for other research projects within FOI.

Participating parties and Contact person

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Publications and dissemination of results

The following publications have been produced by the project and published at conferences:

Principles for animal thermal simulation
Title: Infrared animal modeling for training ATR algorithms.
Published and presented at the conference:
Unmanned/Unattended Sensors and Sensor Networks at SPIE Symposium: Security + Defence in Toulouse September 2010.

Classification of Driving Environment
Title: Real-time road scene classification using infrared images
Published and presented at the conference:
VISAPP 2010 (International Conference on Computer Vision Theory and Applications), May 17-21 in Angers, France.

Internal Seminars

Internal seminars have continuously been held at Autoliv within the field of classification, where the methods and results from this project have been discussed for use within other projects.