ROBIN: a platform for evaluating Automatic Target Recognition algorithms. Part 1: Overview of the project and presentation of the SAGEM DS competition

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ABSTRACT

The last five years have seen a renewal of Automatic Target Recognition applications, mainly because of the latest advances in machine learning techniques. In this context, large collections of image datasets are essential for training algorithms as well as for their evaluation. Indeed, the recent proliferation of recognition algorithms, generally applied to slightly different problems, make their comparisons through clean evaluation campaigns necessary.

The ROBIN project tries to fulfil these two needs by putting unclassified datasets, ground truths, competitions and metrics for the evaluation of ATR algorithms at the disposition of the scientific community. The scope of this project includes single and multi-class generic target detection and generic target recognition, in military and security contexts. From our knowledge, it is the first time that a database of this importance (several hundred thousands of visible and infrared hand annotated images) has been publicly released.

Funded by the French Ministry of Defence (DGA) and by the French Ministry of Research, ROBIN is one of the ten Techno-vision projects. Techno-vision is a large and ambitious government initiative for building evaluation means for computer vision technologies, for various application contexts. ROBIN's consortium includes major companies and research centres involved in Computer Vision R&D in the field of defence: Bertin Technologies, CNES, ECA, DGA, EADS, INRIA, ONERA, MBDA, SAGEM, THALES.

This paper, which first gives an overview of the whole project, is focused on one of ROBIN's key competitions, the SAGEM Defence Security database. This dataset contains more than eight hundred ground and aerial infrared images of six different vehicles in cluttered scenes including distracters. Two different sets of data are available for each target. The first set includes different views of each vehicle at close range in a "simple" background, and can be used to train algorithms. The second set contains many views of the same vehicle in different contexts and situations simulating operational scenarios.

Keywords: Evaluation, Pattern recognition, ATR, benchmark, database

1. INTRODUCTION

Evaluation and benchmarking competitions in computer vision applications happen now each year on a regular basis. Tasks like object detection and recognition, video understanding (TRECVID, PETS), character recognition (ICDAR) are now assessed regularly. The benefits of such approaches are well known as this process initiates a continuous improvement with two major contributing factors.

Firstly, a benchmark campaign is a major mean for animation and motivation of the research community. It provides, free of charge, complete and "ready to use" datasets. Such datasets, which include full "ground truth" descriptions, are known to be difficult and expensive to build. A spontaneous competition rises between research teams, which come along most of the time with a critical analysis of the evaluation methodologies, process or metrics. By pointing out the limits of

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the process, these useful discussions lead to the specification of the next challenge. The process is then constantly improved.
Secondly ; a benchmark campaign allows all actors to have a better understanding of the technology readiness level, of the algorithms the best suited to a specific task, and of the difficulties still to be addressed This visibility is of great importance for industry, which can then decide if the available solutions are sufficient for new successful products or services. In such cases, new financing can be found to increase TRL level and push towards the best innovative algorithms.

These challenges however are usually proposed by some scientific committee (most of the time related to a conference, e.g.. ImageCLEF) or by agencies like the NIST in the USA.

Well aware of the importance of Evaluation and Benchmarking, French Ministry of Research and French Ministry of Defence have funded a large and ambitious governmental initiative for building evaluations means for computer vision technologies, for various application contexts. This program called Technovision includes no less than ten different projects, each one managed by a consortium which includes both images/data providers, potential integrators of vision solutions and research labs.

The criteria used to select the projects were:

- the organizing committee should include representatives from both research laboratories and industrial companies ;
- the aim of the project should be the assessment of image processing applied to industrial tasks ;
- the project should produce an evaluation kit made of datasets (including ground truth) and metrics for the proposed task, and have a strategy to make it widely available over time ;
- the project should take no longer than 30 months, and only the evaluation kit production was funded, at a 50% level.

Each project was dedicated to a specific task, starting at the beginning of 2005 and ending in summer 2007 for the latest projects. More information can be founded on each projects web site :

- ARGOS : Surveillance Tools and Video contents [http://www.irit.fr/argos]
- EPEIRES : Symbols recognition [http://www.epeires.org]
- ETISEO : Video Understanding [http://www.etiseo.net/]
- EVALECHOCARD : Echocardiograms processing
- IMAGEVAL : Images Indexing and Retrieval [http://www.imageval.org/]
- IV2: Face and Iris based Biometrics [http://lsc.univ-evry.fr/techno/iv2/PageWeb-IV2.html]
- MESSIDOR: retinal ophthalmology http://messidor.crihan.fr/]
- RIMES : handwritten data recognition and indexing [http://www.int-evry.fr/rimes/]
- TOPVISION Underwater Images processing
- ROBIN : Automatic target detection and recognition in Air/Ground and Ground contexts [http://robin.inrialpes.fr]

We will now focus on the Robin project which is the “Defence oriented” component of the Technovision initiative.

2. ROBIN : A PROJECT DEDICATED TO ATR

Objectives

Over the last few years, a considerable amount of research has been devoted to image classification or object recognition methods, supported mainly by applications such as images or video retrieval, video-surveillance or biometrics. With very few exceptions, all this work focused on learning approaches, using various forms of SVM or boosting algorithms. Promising results have been achieved in some international challenges like Pascal VOC.

On the other hand, the performances of Automatic Target Recognition solutions proposed in Defence equipments or systems remain far from operational needs. Robustness again partial occlusions or poor S/N ratio, management of a large number of classes, reliability of performance prediction are among the recurrent problems underlined by final users in most of the contexts.

Trying to benefit from these new innovative learning techniques in defence applications raises several difficult challenges both in terms of algorithms techniques, R&D methodology, and industrial deployment of the solution. The following figure illustrates the main differences between “Civil” context and “Military” context regarding object recognition function.

			
Algorithms Challenges	**Color images**	/	**IR images**
	Low/No noise	/	**Medium/High Noise**
	Large size object	/	**Very poor size object**
	Object = subject of the picture	/	**Uncooperative Object**
	Object / Background correlation	/	**Poor Object / Background correlation.**
	Separated objects classes	/	**Close objects classes**
	One object per picture	/	**Many objects per picture**
	No Background/Unknown class	/	**Background - Unknown classes**
Methodological Challenges	**Localization not always required**	/	**Precise detection required**
	Medium range performance. acceptable	/	**High performance required**
	Prediction of performances not required	/	**Prediction of performances required**
	Amount of learning data	/	**No/poor learning data**
Industrial Challenges	**No or poor Hardware constraints**	/	**Strong Hardware constraints**

Furthermore, military images databases or target models are often Confidential. This has been a strong restriction regarding the scientific community motivation and/or potential to take up algorithms and methodological challenges.

So the main objective of Robin project is to provide research teams with unclassified databases which are representative of military applications. They will then be able to analyze the performances of their best algorithms and study innovation solutions in order to improve them.

The scope of this project includes :

- multi-class object detection
- generic object detection
- generic object recognition

- image categorisation

Participants:

ROBIN consortium includes several major French Defence and Security companies and majors French research laboratories involved in Image processing and Pattern Recognition. More details can be found in [1].

Project management and coordination was assumed by INRIA.

Project Coordination and Scientific committee:

CNRS/INRIA-LEAR, ONERA, DGA/CEP

Industrial Members :

MBDA, EADS, Bertin Technologies , Sagem Defence Security, ECA, THALES ,CNES

Academic expertise:

ONERA, UTC, INPG,CNES, ENST, INPG,INT, INRIA

Academics Members

LIS-GOTA, LIRIS , GREYC , C3ED , Eurecom , Le2i , L3i , LIS-SIN, LIS-GOTA , LIP6 , ISEN , LVR , INRIA - LEAR , L2S , UIUC , LI Tours , LSIIT , LASMEA , ETIS , LIMSI , PSI , LGI2P , SIP , LSC , IETR , ISTIT , LERI , LIRMM , INRIA-IMEDIA , LISA

Robin project databases

Six different databases have been created corresponding to several contexts, sensors and functions.

Dataset #1 : Multi-class object detection with view point changes

This dataset has been produced by Bertin Technologies and ECA. This dataset is provided to evaluate performances of object detection algorithms in ground-to-ground surveillance context. It includes both Infrared (8-10 micron) and visible data.

Objects of interest will belong to several categories of civil vehicles like tourism cars (4 different vehicles), motorbikes, 4 wheeled vehicles (2 different vehicles), people (walking, standing, running, being at a window, etc) and various kinds of obstacles or buildings. Three different datasets with their ground truths will be available for training (1000 images), validation (4000 images) and testing (10000 images).

Functions to be evaluated include: Detection of humans and vehicles, Discrimination of humans and vehicles, Discrimination of human postures

Dataset #2 : Generic Object classification in satellite images

This dataset has been produced by CNES and contains panchromatic SPOT 5 satellite images (1 pixel = 2.5 m). Each image covers a 60x60 km^2 area representing different regions.

The dataset contains 10000 regions of interest (128x128 pixels) belonging to one of these 10 categories:

1. Roundabouts, 2. Crossroads, 3. Highways and trunk roads ,4. Secondary roads, 5. Minor roads , 6. Tracks and lanes

7. Insulated building , 8. Suburban area, residential area, 9. Bridges, 10. Railways

"Background" ROI are also given. Ground truth consists in the name of the category, a binary mask, the corresponding multi-spectral ROI (at a lower resolution).

Functions to be evaluated include : Detection of linear structures ("Tracks", "Minor Roads","Highways", "Secondary roads" or "Railways"), Detection of compact structures ("Insulated building", "Crossroads", "Bridges" or " Roundabouts"), Detection of unknown structures, Discrimination of linear structures ("Tracks", "Minor Roads","Highways", "Secondary roads" or "Railways"), Discrimination of compact structures ("Insulated building", "Crossroads", "Bridges" or " Roundabouts"), Discrimination of unknown structures, Detection of linear structures ("Tracks", "Minor Roads","Highways", "Secondary roads" or "Railways"), Detection of compact structures ("Insulated building", "Crossroads", "Bridges" or " Roundabouts"), Detection of unknown structures

Dataset #3 : object detection in aerial images

This dataset has been produced by EADS by merging high-resolution aerial images with computer generated objects. This technique allows us to produce highly realistic images at a low cost.

20 different objects are used to generate about 10000 test images, including different view points and lighting conditions.

Functions to be evaluated include: Discrimination of small planes, Discrimination of any plane, Rejection of big planes , Discrimination of cars & vans, Discrimination of any vehicle, Rejection of long vehicles , Detection of small planes, big planes, or any plane ,Detection of small vehicles, long vehicles, or any vehicle.

Dataset #4 : Robustness of detection algorithms

This dataset has been produced by MBDA. This dataset has been made of computer generated images. These kinds of images make the production of images with very different sensor models and lighting conditions easier. Once the scenes are modeled, the generation of a series of images with different levels of difficulties (noise, occlusion, weather conditions, view point changes, etc) can be produced at low cost.

12 different object categories are used. A learning data set includes up to 15000 samples (1300 per class) representing the different views of the different objects. A validation (2400 images) and a test set (15000 images) as well as their associated ground truths are also provided.

Functions to be evaluated include: Discrimination of vehicles (Planes, Helicopter, Ground Heavy and Ground Light), Detection of Vehicles , Detection of Telecom Tower

Dataset #5: Image categorization

This dataset has been produced by THALES and contains multi-sensor aerial images obtained from a six hours of video recorded from a helicopter at different altitudes, different contexts (urban, suburban, expressway, rural or water-coast) and conditions (night and day). The sensors comprise 3 infrared sensors (bolometer, InSb, QWIP) together with a high resolution visible fisheye. The datasets will consist of 1500 images and 5000 annotated objects classified in 6 main categories of cars, trucks, bus and boats and 13 subcategories.

Annotations of images comprise: date, type of environment, altitude, characteristics of sensor, size of image, type, location and subclass of objects included in image, resolution of pixel (between 8 and 30 cm).

Functions to be evaluated include: Discrimination of Vehicles (Car, Truck, Bus), Discrimination of Cars (Moving Car, Parked Car)., Detection of Boats, Detection of Cars, Detection of Vehicles (Car, Truck, Bus)

Dataset #6 : Multi-class object detection in Ground and Aerial images

This database has been produced by Sagem Defence Security and will be presented in detail in the following paragraphs.

3. SAGEM DEFENCE SECURITY COMPETITION

Objectives

Target Detection, Recognition and Identification Functions are the final purpose of most of Sagem Defence Security equipment such as: Binoculars and thermal cameras, Optronic sights and fire control systems, UAV, Surveillance systems, IR missile guidance systems, Biometric systems or video surveillance systems …

Among these functions, only Target detection functions are actually realized automatically, with high performances, by specific real-time algorithms. Target Recognition and Identification can be achieved automatically with success only on some specific applications such as Air/Ground Missile Guidance with mission planning or Biometric systems. But state of the art in generic object recognition doesn't seem to allow us to reach the mandatory performances in several operational contexts. For example, strong guarantee of performance is required for applications such as seekers in order to avoid collateral effects.

Through its participation in the Robin project, Sagem Defence Security aims to invite the research community to give its best effort on the specific pattern recognition problems raised by military applications. Furthermore, this competition is a great opportunity to identify serious scientific partners for further research studies or industrial collaborations.

In such context, the main specifications of Sagem Defence Security Robin Database were:

- To include non classified IR images
- To include objects representative of military targets in terms of size, inter-classes variability, intra-class variability, IR signature variability ...
- To include both Ground to Ground and Air-to-Ground images, in order to address a larger class of applications
- To include training images taken at close range, with several object positions and signatures, with a ‘simple’ background, same as those than can be recorded on military targets during specific trails.
- To include test images which illustrate various levels of difficulty, such as similar objects at different distance or with different levels of occlusion.
- To include test images with complex backgrounds, such as those observed in operational contexts.

This database allows us to evaluate algorithm performances on four functions: Detection of vehicles, Detection of people, Detection of infrastructure elements, Discrimination of cars.

Types of Targets and distracters

The following table presents the different types of targets in Sagem DS database. Class, Sub-class and Sub-sub-class types in bold font are present in both Training and Test Databases. Others are only included in the Test Database in order to evaluate the generalization ability of the algorithms.

<table>
<tr><th>Class</th><th>Sub-class</th><th>Sub-sub-class (training+test)</th><th>Sub-sub-class (test only)</th></tr>
<tr><td rowspan="6">Vehicles</td><td>City Car</td><td>Peugeot 106,
Renault Clio</td><td>Peugeot 307, Volkswagen Golf, Peugeot 205, 206, 306, Citröen Twingo, AX, undefined</td></tr>
<tr><td>Saloon</td><td>Citroën Xsara break, Renault Megane</td><td>Renault Laguna, Ford Escort, undefined</td></tr>
<tr><td>Utility Vehicle</td><td>Renault Express, Peugeot Partner</td><td>Peugeot Expert, undefined</td></tr>
<tr><td>Monospace</td><td></td><td>Renault Scenic, Espace, undefined</td></tr>
<tr><td>MPVs</td><td></td><td>Citroën C25, undefined</td></tr>
<tr><td>4 Wheel Drive</td><td></td><td>undefined</td></tr>
<tr><td rowspan="2">Landmarks</td><td>Street Light</td><td>Street Light ;
double Street Light</td><td></td></tr>
<tr><td>Others</td><td>traffic lights, pylons, bus stops</td><td></td></tr>
<tr><td rowspan="2">Persons</td><td>Pedestrian Standing Up</td><td></td><td></td></tr>
<tr><td>Cyclist</td><td></td><td></td></tr>
</table>

Each car of the training database has been viewed in the same conditions, that is to say:

- Each car was captured at 2 distances : 50 m et 100 m
- 3 of the six cars were captured for two states: Cold engine and Warm Engine (Peugeot 106, Xsara Break and Renault Express). The 3 others were captured only with a warm engine
- Each car was captured for 7 presentations : 0°,30°,60°,90°,120°,150°,180°

All the street lights have been taken from different view points, what represent 10 different pictures for the training database.

All the person class elements have been taken from different view points, what represents 10 different pictures for the training database.

Every object of the training database has been used for the test database, plus some distracters. Objects from the training database have been captured in a real environment at difference distances, orientation and so on. For instance some vehicles have been captured while parked, or on a country road among other cars (referred as distracters). Furthermore, these vehicles have been captured at different distances along a film, with different orientation, sometimes partly hidden .

The three different classes of objects are present in the test database. All the objects of the test database are represented in a real environment. Some distracters have been added.

Sensor description

The Sagem Defence Security database has been acquired with an Infrared Sensor goggle JIM LR (Long Range Multi function binoculars). Its main characteristics are:

Waveband= 3-5 µm (cooled)

FPA technology = InSb

384x256 Matrix FPA

Pixel Pitch = 25 µm

Dynamic Range = 14 bits

Basic Integration Time = 3 ms

Frame Rate = 50Hz

NETD < 50 mK

Field Of View 22° x 14,5° (JIM LR is a dual FOV binocular with a Wild FOV of 9°x6° and a Narrow FOV of 3°x2°) This larger FOV has been obtained thanks to a specific and optional optical equipment.

The data has been collected by the mean of a computer able to acquire the 14 bits digital Video in real Time without losing any frame for at least 6000 frames. The recorded frames haven't been through any Image Processing, except a Non Uniformity Correction able to compensate gain and offset of the FPA. As the scene can be composed of various objects with very different mean dynamics, an Automatic Histogram Control is compulsory in order to comfortably watch the scene. This is an embedded function in the JIMLR which allow the users either to watch the Controlled picture in a Binocular Display Module, or through a CCIR monitor. This Automatic Histogram Control does not affect the 14 bits digital recorded video.

4. GROUND TO GROUND DATABASE REALIZATION

Acquisition means description

One of the keys to properly achieve the realisation of the Ground To Ground Database has been the supply chain management. A Utility Vehicle with an embedded battery for power supply has been used for these experiments, thanks to Sagem Defence Security's Trails Support Services. The computer described above has been used for recording the data, in conjunction with a CCIR monitor. A tripod has been used for commodity in some cases. It is important to remember that no stabilization platform or algorithm has been used to collect the data. A basic weather station has been also used to collect several atmospheric parameters.

Finally, a minimum of three operators have participated to the Ground to Ground database realization (mainly to drive the cars). They communicated together by Walkie Talkie.

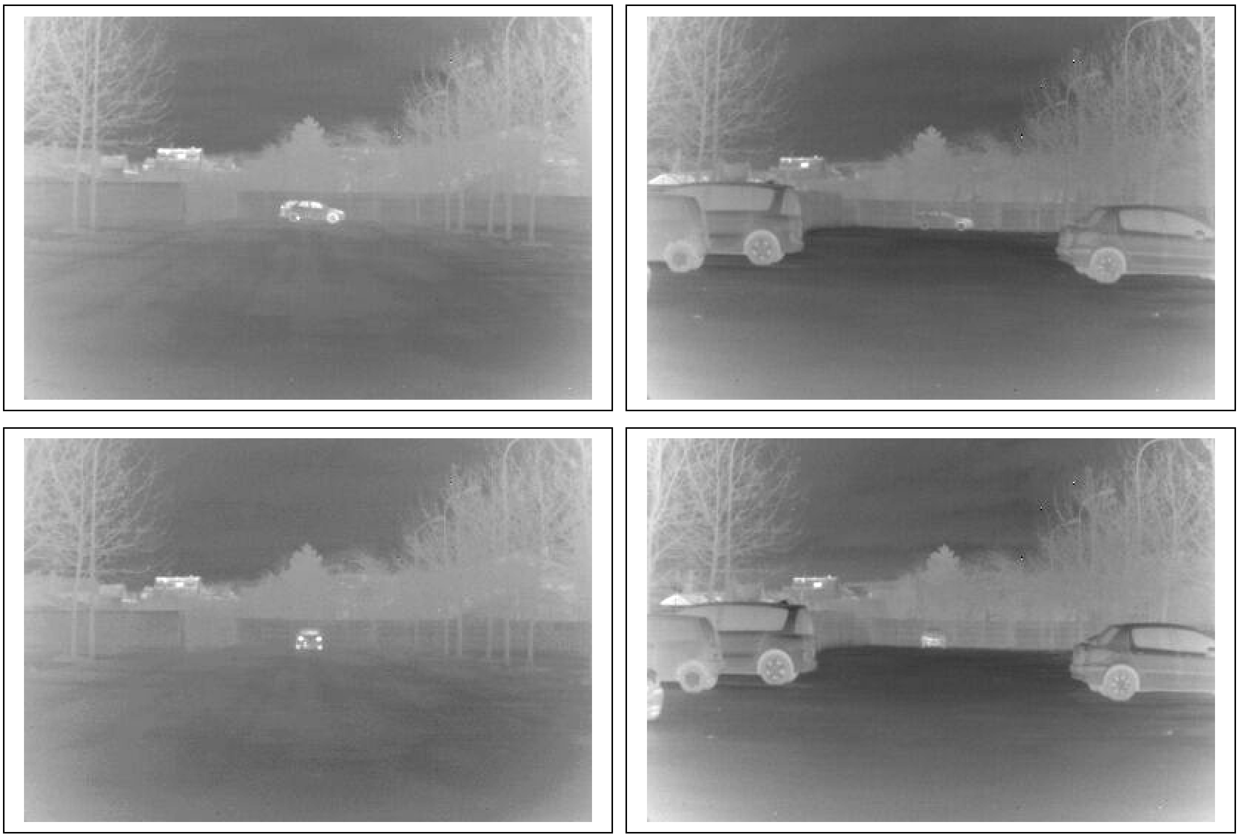
Campaign realisation

Ground-to-Ground images sequences have been acquired on three different dates between Sept 2005 and May 2006:

- 2005-09-12 in cloudy hot weather. Training sequences of Renault Express and Peugeot 106 with cold and hot engine, at 50m and 100m. Various tests sequences in urban and country background.

  2005-09-13 in clear weather. Training sequences of Renault Express and Peugeot 106 with cold and hot engine, at 50m and 100m. Various tests sequences in country background.

- 2006-01-12, 13 and 18 in clear weather. Training sequences of Citroen Xsara Break with cold and hot engine, at 50m and 100m. Various tests sequences in country background.
- 2006-05-26 in cold and rainy weather. Training sequences of Clio, Peugeot Expert, Renault Megane, with hot engine, at 50m and 100m. Various tests sequences in country background.



Images from the training dataset: Citroen Xsara break

Images from the test dataset: Various vehicles and distracters

5. AIR TO GROUND DATABASE REALISATION

Acquisition means description

To complete the Air to Ground database, a Helicopter has been required. The JIM-LR was fixed on a platform to achieve the three angles described below. This platform has been put in a kind of compartment (the same used with rescue helicopter) outside the helicopter. Thus the integration time has to be lowered to its minimum in order to avoid any blur due to movements. Consequently, the signal to noise ratio was also decreased. The same PC was used to record the images with a CCIR monitor to watch the observed scene. The Melun airport (located south of Paris) hosted the air to ground realization and two days and three operators were needed to prepare the database acquisition. Two other days were needed to record the database. We also brought an Uncooled camera to acquire the same objects, but these images are not included in SAGEM Dataset.

Observed Targets

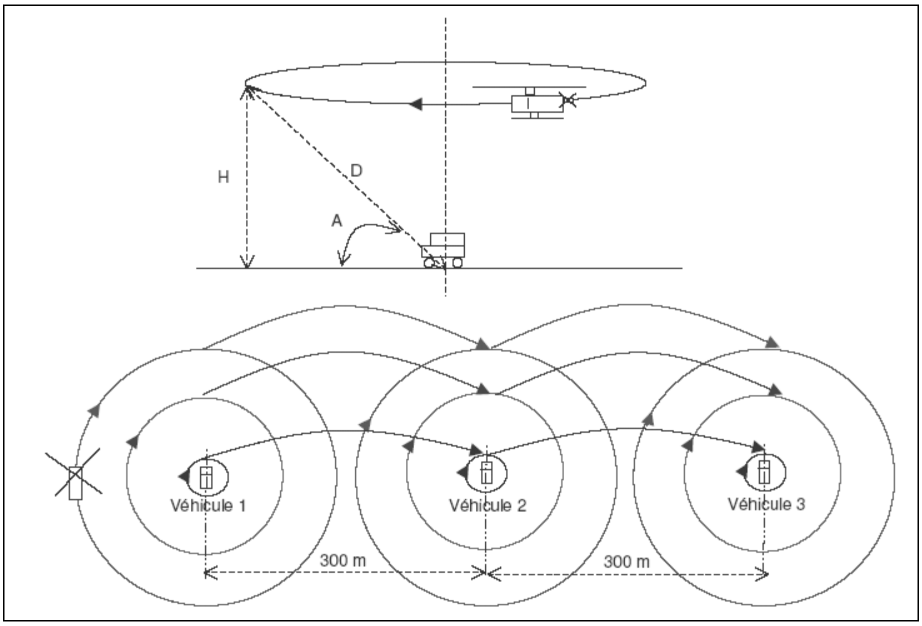
We used the following vehicles for the training Air to Ground database. Peugeot 106, Citroen Xsara break et Renault Express. The same vehicles were also acquired for the test database, fixed or moving at different speed, only two of them or the three of them with a large panel of orientation.

Campaign realisation

The orientation and conditions were the same that the one for the Ground to Ground database, that is to say:

- Each car was imaged at 2 distances : 50 m et 100 m
- Each car was imaged for two states: Cold engine and Warm Engine
- Each car was imaged for 7 presentations : 0°,30°,60°,90°,120°,150°,180°

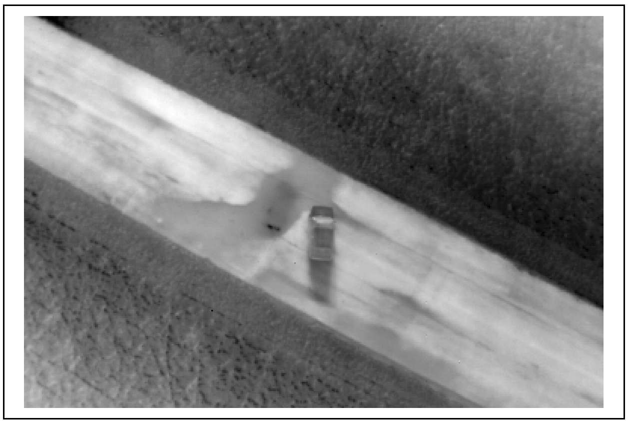
Moreover this different view has been acquired for 3 different angles of the JIM LR goggle: 30°, 60° and 90° (an example is given on the following drawing).



The Air to Ground database has been carried out on 2006 – March 01 & 02 with very dry but cold weather (below 0°C)

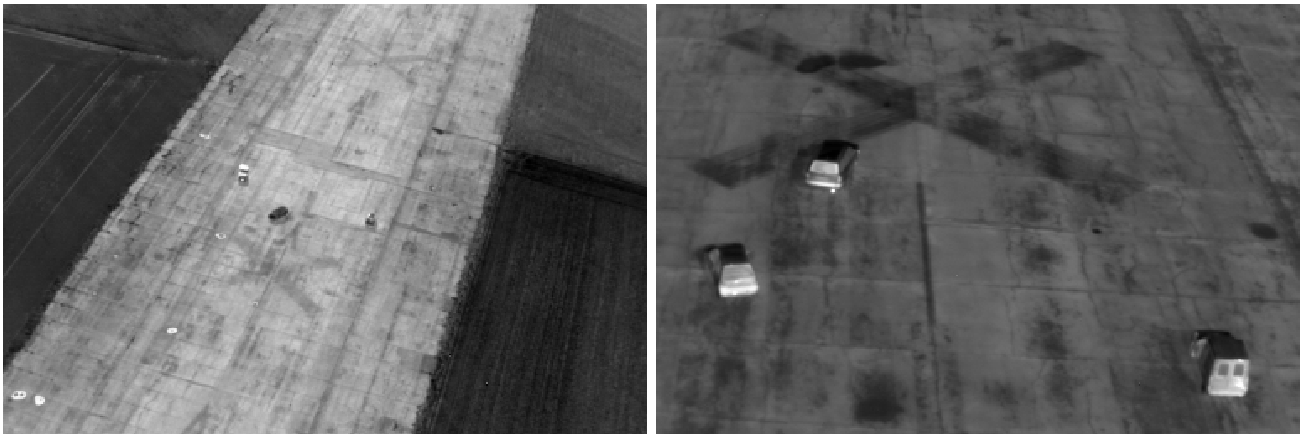
For the training Air to Ground database 180 frames has been acquired under the indexation process.

We give an example on the two following pictures.



Images from the training dataset: Citroen Xsara break at 90° and 100m and Renault express at 30° and 50m

For the test database, the same vehicles in real situations were acquired. We also merged these vehicles with pedestrians. The two following images give an example of the various test images.



Images from the test dataset: The three vehicles at two different distances

6. DATABASE INDEXATION

One thousand hours were needed to achieve complete database gathering and indexation tasks. A specific software was developed in order to ease the indexation of all those pictures. Each object was located by four points defining a box around the object. Class, Sub-class and Sub-sub-class are then attached to the object, which can be completed with optional comments. An xml file which collects all indexation information, is attached to each image.

Below is an example of a frame and its associated indexation file to illustrate the complexity and therefore the time needed for this task.

Image Set	*SAGEM*

Filename	Format	Dynamique	Width	Height	Type	Compression	Noise
BA_express_100m_030°_mf_GC_0000.tif	TIF	16	384	256	IR II	aucune	faible

Séquence d'origine

Nom	Durée	Nombre d'Images	Numéro de l'image dans la séquence
express_030°_mfroid_loin.pcr	1.052000e+001	526	0

Capteur

Type d'imageur	Résolution (taille pixel en µm)	Focale en mm	Shutter
JIM_LR_MK3_InSb_diviseur_focale	25	25	defocalisation

Conditions

Day (French format)	Time	Pressure	Incidence Angle	humidity	Weather
13/09/05	14:21:52	1025 hPa	0	55	Eclaircies

Objects

Number of objects	15

Object ID	Class	SubClass	SubSubClass	Xmin	Ymin	Xmax	Ymax	Distance en m (0 = non disponible)	Etat (nd = non disponible)	Notes
car01	vehicle	utility vehicle	renault express	164	83	199	103	100	cold	parking, angle about 30°
car02	vehicle	city car	nd	1	93	27	173	0	nd	Parking
car03	vehicle	city car	nd	1	85	42	164	0	nd	Parking
car04	vehicle	monospace	nd	1	72	93	150	0	nd	Parking
car05	vehicle	saloon	nd	87	86	119	122	0	nd	Parking
car06	vehicle	nd	nd	104	87	122	108	0	nd	Parking
car07	vehicle	nd	nd	112	85	135	108	0	nd	Parking
car08	vehicle	nd	nd	362	88	383	145	0	nd	Parking
car09	vehicle	saloon	nd	278	79	383	140	0	nd	Parking
car10	vehicle	nd	nd	271	81	325	114	0	nd	Parking
car11	vehicle	nd	nd	250	79	305	115	0	nd	Parking

A Training image and associated xml file including indexation and comments.

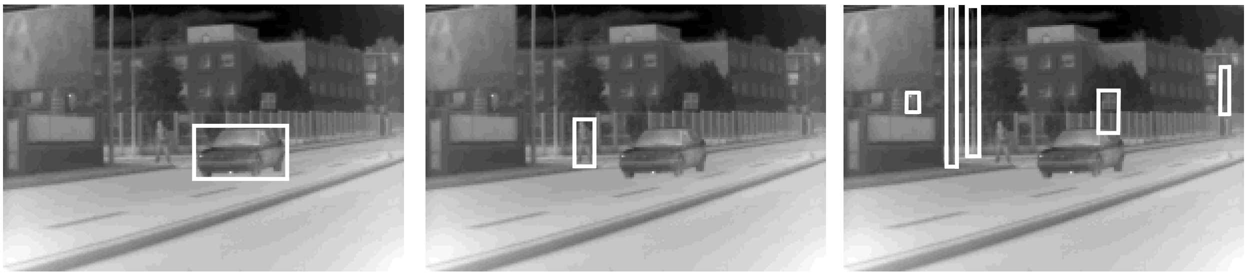


Illustration of indexation in a test image (left to right): Car class object, Person class object, landmarks class objects.

7. SUMMARY OF SAGEM DS DATABASE

The following table summarizes Sagem Defence Security Database.

	Training images	Validation images	Test images
Detection Task 4 Wheel vehicles detection People detection Street Light detection	317	41	367
Car Categorization Task	317	42	375

8. CONCLUSION

The Sagem Defence Security competition of the ROBIN project has led to the creation and dissemination of an important dataset of indexed infrared images. This point is important: industrial companies as well as the Ministry of Defence have expressed a need for advanced image processing applied to this kind of imagery. However, because of the cost of the acquisition devices and of the influence of multimedia applications, most of the research laboratories work only with standard video or photographic colour images. The existence of this set of images is now an incentive for researchers to study these problems.

For the Ministry of Defence, the outputs of this competition will help to define performance specification in the research program 2ACI, starting in 2008. The performance of the algorithms to be developed in this new program will be compared to the results obtained by ROBIN competitors using the same datasets and metrics, thus making it possible to fund the development of state-of-the-art algorithms with a realistic and measurable targeted performance.

Details about protocols and metrics used for evaluating algorithms and actual results obtained from Sagem Defence Security database can be found in [3].

9. REFERENCES

[1]INRIA-Robin Consortium : *ROBIN : Recherche d' Objets dans des Bases Images Numériques*, V4, Final proposal Oct 2004.

[2] E. D'Angelo, S. Herbin and M. Ratiéville, *ROBIN Challenge: Competitions*,
http://robin.inrialpes.fr/robin_evaluation/downloads/ROBIN_competitions_v2.pdf

[3]D. Duclos, J. Lonnoy, Q. Guillerm, F. Jurie, S. Herbin, E. D'Angelo, *ROBIN: a platform for evaluating Automatic Target Recognition algorithms Part 2: protocols used for evaluating algorithms and results obtained on the SAGEM DS database*, SPIE Defense and Security Conference, 2008.