Chapter 29

Pattern Recognition Research at the IRI-CSIC/ESAII Group

PATTERN RECOGNITION RESEARCH AT THE IRI-CSIC/ESAII GROUP

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Abstract. The pattern recognition group formed by researchers in the IRI-CSIC and the ESAII Dept at the UPC has been created four years ago but its activity is very high participating in research projects, international publishing and organizing relevant events such as ICPR'00. In this paper we show part of this activity.

1. INTRODUCTION

The group that we belong to, has been created in 1996 by a mutual research interest. The people coming from ESAII Dept had long experience in hardware development of computer vision algorithms, while the people at IRI-CSIC had huge experience in structural pattern recognition and software algorithms development. With this blend of knowledge, we achieved a new group with the capability of implementing in hardware devices (or new architectures) new algorithms of structural patter recognition. After this period, the experience has been very productive and, in the personal field, the relationship has been excellent.

The leadership is carried by Prof. Alberto Sanfeliu and the members are Dr. Antoni Grau, Dr. Joan Climent, Dr. René Alquézar, Dr. Francesc Serratosa, Dr. Joan Aranda, Jaume Vergés and Juan Andrade. There are also some students (undergraduate mainly) working in specific areas of interest for the projects.

2. RESEARCH TOPICS

The Group is working mainly in Computer Vision, Mobile Robots, Pattern Recognition and Automatic Learning. Other areas of interest are Computer Architectures and their hardware implementation.

3. RESEARCH PROJECTS OF THE LAST FOUR YEARS

Active Vision System Based in Automatic Learning for Industrial Applications

Reference: TAP98-0473

Time frame: 12/1/98 a 11/30/01

Project Coordinator: Alberto Sanfeliu Cortés

Key Words: computer vision, automatic learning, pattern recognition, mobile robots, VLSI

Summary

The objective of the project is the development of an active vision system with learning capabilities for industrial applications. The main issue to be resolved is the reduction of specific analysis, development and implementation of vision systems in, for example, unstructured environments (for auto-location applications in industrial or public buildings for automatic cleaning systems), or, for example, in environments where the access is extremely difficult (for maintenance tasks in the gas and water distribution industry). With this system we want to reduce the complexity of vision sensors in industrial applications and to extend its scope of use.

In the project, relevant automatic learning techniques will be analysed to acquire the environment from a sequence of images obtained by means of a mobile robot, the minimum number of robust computer vision and pattern recognition techniques to be integrated in a active vision sensor will be studied, a prototype of the sensor will be developed and the use of the sensor in a pseudoindustrial work area will be verified. The potential applications of such sensor are in the manufacturer, distribution and service industries. Moreover, the sensor is also applicable in the automotive industry.

In the pictures below, the robot "Marco" is used as a testbed for the development of the navigation algorithms using computer vision. Also, all the images for automatic learning are obtained from the cameras mounted in the stereoscopy head at the top of the robot.

Figure 1. Marco playing with a child toy.

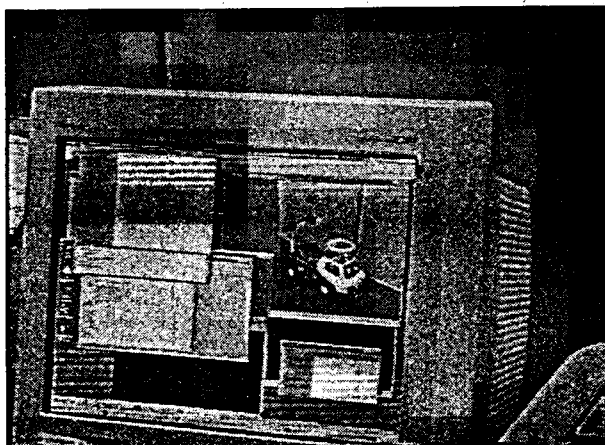**Figure 2.** Marco and its head.

Figure 3. Station for processing the information sent by Marco and navigation monitoring.

Construction of R&D Environement for Artificial Vision

Summary

This project puts forward the standardisation on a nation-wide scale of an Artificial Vision Software, in order to use it for the development of industrial and scientific applications. To achieve this purpose, we intend to create different modules which will be part of a software environment for the development of applications in vision (i.e. card drivers, image processing kernel, programming interface, and modules of specific methodologies) for a several platforms as well as for working environments. All this software will be developed jointly by the parties of researchers that propose this project.

The project will be based on software developments made by the parties taking part in it, particularly in the ViLi environment, which has been developed by the Computer Vision Group of the Universitat Autònoma de Barcelona. ViLi is also used for research, and educational purposes. It tries to widen the characteristics of the development that have been made by the participant parties. In this way, it eliminates the inadequacies that limit its use in the research field. The project is also aiming for extending its use to the scope of applications development.

The specific objectives of the project are focussed on the development of a working environment in Artificial Vision composed by a kernel, specific modules, users interfaces, and drivers. All these elements will be used to link the environment to the cards of processing images that are available at present.

The results of this project with respect to its standardisation will be shared with the rest of the scientific community, and the will be open to future collaborations. The resulting kernel will be of public domain although every single group will retain the right to use the rest of the modules.

The following step to be taken would be the creation of a Spanish software-hardware system that can be competitive in the market. This system could be developed as a specific project in collaboration with other institutions and companies that would be lidded by firms of the sector.

4. FUNDING

5. PUBLICATIONS OF THE LAST FOUR YEARS

We include in this section the publications of the last four years.

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6. RESEARCH ASSOCIATIONS

The Group belongs to the Spanish Association for Pattern Recognition and Image Analysis and to the International Association for Pattern Recognition. Moreover one part of the Group belongs to the Consejo Superior de Investigaciones Científicas (CSIC) of Spain.

The group participes actively in the organization of the ICPR'2000, held in Barcelona 3-7 September 2000 and organizes completely the *Foro Iberoamericano de Reconocimiento de Formas y Análisis de Imágenes,* held in Barcelona on 8 September.