



EURON
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European Robotics Network

EURON INTRODUCTION/SUMMARY:

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EURON – The European Robotics Network

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Introduction

The pursuit of a major research goal requires involvement of a research community. In many areas of research the pursuit of major scientific or technical goals has been achieved through involvement of a large body of the associated research community. In robotics this has recently been witnessed as part of the Japanese effort on Humanoid systems (headed by Prof. H. Inoue, University of Tokyo). In a similar vain has the American community been integrated through a number of joint effort in particular sponsored by the US military, through programmes such as the Mobile Autonomous Robot Systems (MARS) sponsored by DARPA. These joint programs serve several purposes including integration of competencies across universities and companies, achievement of cohesion in research strategy, and social integration across different places. At the same time the programmes offer excellent opportunities to promote the science and technology results that originate from joint efforts. It is consequently not surprising that many European researchers have a better view of what is going on at leading US institutions compared to what is going on in a neighbouring country. By 1998 a group of EU researchers met at the French embassy in Japan, for informal discussions. The need for further coordination of EU research was easily identified. To address this problem a network of excellence has been setup by the European Commission. The network is named European Robotics Network – EURON (<http://www.euron.org>). It is sponsored by the Future and Emerging Technologies office within the CEC. In this paper the basic structure and activities of EURON are presented together with a view towards the future.

The European Robotics Network has been setup to have broad involvement of robotics across the many different fields of applications and research. In addition the aim has been to involve as many groups as possible. At present the EURON network involves about 130 groups covering almost all countries in Europe. The distribution of members across nationalities is shown in figure 1. As can be seen the major countries involved are Germany and Italy. Together they represent 50% of all the members. This is also in strong agreement with these countries have strong national programmes in robotics. In addition both Germany and Italy have manufacturers of industrial robots.

Activities

The activities within EURON are organised around 5 major efforts, referred to as Key-Area activities. They are:

- Research co-ordination
- Training and Education
- Industrial Links
- Dissemination
- International links

¹ Henrik I Christensen is the coordinator of EURON

The effort within each of these areas is described below:

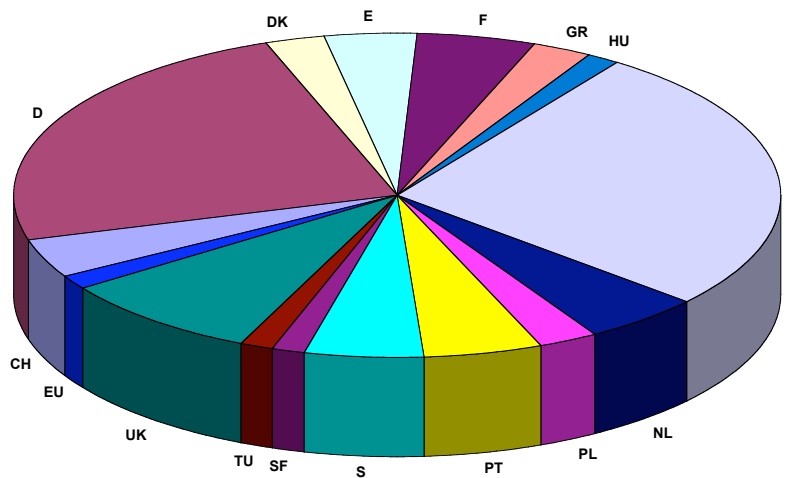


Figure 1: Distribution of EURON members across countries.

Research Coordination

The research coordination is responsible for two major activities: i) definition of a research roadmap for Europe, and ii) definition of benchmarks for R&D.

In Europe there are a number of national programmes on robotics such as the ROBEA programme in France and a number of Sondern Forschung Bericht (SFB) in Germany (SFB's are major multi-partner research projects with a duration of 8-12 years). In addition there has been a number of robotics projects sponsored by the European Commission through the diverse set of topical programmes with the EU framework programmes (see www.cordis.lu for an outline of these programmes). It is, however, characteristic that there has been limited or no joint effort to define a European vision for the R&D effort within the region. At the same time it must be recognized that a large share of manufacturing of industrial robots originate from Europe through companies such as ABB and Kuka. Consequently to provide a research vision for Europe a joint effort to define a “research roadmap” has been undertaken. To this end researchers were invited to submit “research dreams” on particular topics. Based on analysis of the research dreams a draft roadmap has been defined. The roadmap involves an analysis of state of the art, identification of major obstacles to progress, and a definition of potential topics for joint research programmes. One of the side-effects of the definition of the roadmap was a joint set of hearings with the CEC in preparation of the initiation of the EU 6th framework programme that was initiated 2004. The end result was the setup of a new research programme named “Beyond Robotics”. The term “beyond” refers here to R&D that does beyond the present industrial market.

It is still relatively rare to see research results that are utilized across laboratories. If results are reused across different institutions then it is most frequently through a re-implementation of methods reported in the literature. In addition there is relatively little comparative research where the same experiments are replicated across institutions. This is in contrast to well-established empirical research in other domains. To address this issue a study has been performed in an attempt to define benchmarks for research across the different areas of robotics.

The effort on research co-ordination is chaired by Rudiger Dillmann, University of Karlsruhe and Paolo Dario, Scuola Superiore Sant'Anna.

Education and training

A key resource for establishment and maintenance of a strong research effort is human resources. Consequently it is essential that there is access to strong educational and training efforts across Europe. To this end the Key-Area of education and training has pursued three efforts: i) a survey of education on robotics in Europe, ii) setup of mechanisms for sharing of resources for education, and iii) organisation of a number of European Summer Schools.

Throughout Europe there are many educational efforts on robotics. Today these efforts are in no way coordinated and there is limited insight across national boundaries. Consequently it is difficult to compare programmes on robotics between, say, Greece and Sweden. To change this situation the effort has attempted to do a survey of educational efforts across the many different shapes in which it is taught (Mechatronics, Electrical Engineering, Control Engineering, Mechanical Engineering, Computer Science, etc.). At present a summary overview is being prepared. One of the side effects of this is an attempt to define a set of model curricula for teaching of robotics in various fields.

Many teachers invest significant resources into lecture material and exercises. In many respects it is desirable to have a mechanism for reuse of this material across schools. This, however, opens up another issue of organisation of topics. I.e. it would be desirable to have a taxonomy of robot topics by which the material can be organised in a manner similar to what has been achieved in for example computer vision (see the online vision compendium www.dai.ed.ac.uk/CVonline). The key-area group has attempted to define a similar structure for robotics. The structure is now available online (<http://www.roble.org>). Recently, a call for educational material was issued. The idea is to allow teachers starting a new course or in need of inspiration, to utilize the material in the web-book to revise her/his own lectures or to base new exercises on material available on the site.

Most universities do not have access to excellent teachers across all areas of robotics. To allow students to receive excellent training on many different topics the EURON network organises summer schools. Such an event is, typically, a one-week course that brings together 20-50 students at one location for studies of a well-defined topic. For such occasions it is possible to invite leading lecturers from all over the world. In addition to the lecturing and participation in joint exercises the event also provides an excellent basis for social interaction between the students, which is of significant importance to establishment more cohesion across the community. It gives young researchers an excellent view of advanced topics, and allows them to establish their own social network with fellow researchers. Each summer EURON organises 3-5 schools on various topics. The topics have included visual servoing, tele-robotics, localisation and mapping, manipulation, human-computer interaction, navigation, cooperative robotics, and mobile systems. Overall the organisation of schools has been extremely well received by the PhD students, and there is in general a 1 to 2 ratio between number of applicants and number of accepted students at these events.

To promote excellence in academic research the EURON network has also setup the Georges Giralt PhD Award. The prize is awarded for an excellent PhD thesis in the area of robotics. As a basis for the evaluation both the thesis and the associated set of publications & patents are considered. The impact of the thesis to the field is thus an important factor considered in the selection of the winner. So far the prize has been awarded three times. In addition to a plague

and a cash price, the winner is offered an opportunity to publish their thesis as a monograph with Springer Verlag.

Alicia Casals, Technical University of Catalonia, coordinates the effort on education and training.

Industrial Links

Europe has a strong record in terms of robotics industries. Today Europe is one of the leading regions in terms of industrial robotics and automation. Many of the major companies have their headquarters in Europe. Examples include ABB, Kuka, Comau, Stäubli, Electrolux, Kärcher, Husqvarna, K-Team, etc. To ensure that Europe can remain one of the leading providers of robot systems it is essential that the industry has access to key research results, human resources and a strong community. As part of this there is also a need for strong interaction between academia and industry. The industrial links area is responsible for the setup and maintenance of close ties between the research community and industrial companies. The industrial links areas has in particular performed three activities: i) outline of strategies for European robotics industry, ii) setup of a prize for technology transfer, and iii) establish a yellow page repository of activities on robotics in Europe.

European industry is as noted above one of the major providers of robotic systems. Industrial robotics has so far had in particular the car industry as one of its primary targets. The industry is evolving to take on new domains and in addition entirely new domains such as domestic and service are emerging as sectors of interest. To this end a group involved key industrial representatives and partners from academia have formulated a white paper on European Robotics (Christensen et al 2001). In addition joint events have been organised to provide a joint forum for discussion of the needs of industry.

The industry (and academia) is a highly in-homogenous community and it is often difficult if not impossible to get an overview of the potential providers and users of robotics technology. To address this issue the industrial links community has defined a yellow-page repository through which providers and users can register and outline their competencies in the domain of robotics. The yellow page facility is organised as a web-site (www.robotics-in-europe.org). The entries are edited to a fixed format to provide coherence in the presentation. The yellow page facilities are co-organised with the European Robotics Forum (ERF - the European part of the International Federation of Robotics – IFR).

To promote technology transfer and use of research results from research institutes and universities a Technology Transfer Award has been setup. The price is jointly sponsored by ERF and EURON. In March 2004 the first edition of the prize was awarded to DLR/Kuka. In addition to a trophy and a cash award the winners are also given an opportunity to prominently advertise the results of the joint venture between industry and academia. The prize will from now be awarded each year.

The industrial links area is coordinated by Martin Hägele, Institute for Production and Automation, and Erwin Prassler, GPS-systems.

Dissemination

Dissemination of results is a crucial aspect of any R&D effort. Dissemination takes on many forms from publication of results in journals and conferences to press-released to the general community. To assist in the dissemination of results from the EURON community a special effort has been setup. The activities has in particular involved three efforts: i) mechanisms for

publication of excellent research, ii) general information to the community and iii) a column in IEEE Robotics and Automation Magazine.

There are a number of channels for dissemination of research on robotics, so far there has, however, been limited high quality book series that covers all aspects of the field. Consequently a joint effort has been setup with Springer Verlag to publish a series of book on the diverse topics in robotics. The book series is named “Springer Tracts in Advanced Robotics – STAR”. The series publishes monographs, such as the theses awarded the Giralt PhD Award, conference proceedings such as the International Symposium on Robotics Research, and selected edited collections. The series is supposed to be international in focus and consequently the editorial team is composed of Bruno Siciliano, University of Naples, Oussama Khatib, Stanford University and Frans Groen, University of Amsterdam. So far 9 volumes have been published in the STAR series and it is off to an excellent start. Another 7 volumes are in preparation.

To ensure that the community is aware of the large variety of activities taking place, be they sponsored by EURON or other actors, a joint www facility is required. In addition efficient mechanisms for distribution of information are required. To this end a unified facility has been defined and brought on-line. The www.euron.org facility contains a complete coverage of the activities within Europe and it contains pointers to other activities world-wide. The EURON site is today a major site for distribution of information about robotics in particular within Europe. The maintenance of the site as been subcontracted to the company GPS, that also is responsible for the editorial handling of material. The site is a crucial mechanism for added awareness of activities through out the European region.

EURON also provides technical sponsorship for a wide variety of conferences such as IAS, IAV, ASER, etc.

Finally an agreement has been reached with the IEEE Robotics and Automation society that a column is published in each issue of the Robotics and Automation magazine to report on major activities in Europe.

The key-area on dissemination is co-ordinated by Bruno Siciliano, University of Naples and Frans Groen, University of Amsterdam.

International links

While there is a strong need for coordination of robotics R&D across the European countries it is important to recognize that EURON is not alone and in addition there are other efforts to coordinate robotics efforts worldwide. Consequently there is a need to build strong ties to other communities. Consequently the EURON effort has an effort to liaison with such communities. As part of this effort memorandum of understanding has been signed with the European Robotics Forum (ERF), and The International Association for Robot Progress (IARP). In addition non-formal links have been established with IEEE Robotics and Automation Society (RAS), and the International Federation of Robotics Research (IFRR). The coordination of interaction with other efforts in robotics is organised by Georges Giralt, LAAS.

Perspective

As mentioned earlier a new programme on robotics has recently been launched by the European Commission as part of its 6th Framework Programme (FP6). The “beyond robotics” programme (www.cordis.lu/ist/fet/ro.htm) is directed towards three topics areas: i) robotic companion (service robotics), ii) human bionic systems (neuroscience – robotics interaction), and iii) communities of robots (coordination of a large number of robot systems). In addition an

associated effort has been defined to provide community support. Through a competitive call a new Network of Excellence – EURON-II has been awarded a grant to coordinate the community effort for the period 2004-2007. By early 2004 the European Community will integrate a number of new countries into the community (in particular countries from Eastern Europe). Consequently a major effort for the short-term future is integration of research efforts from these countries into the wider European robotics community. In addition the EURON-II effort will have new mechanisms for sponsorship of prospective research projects – this can be considered research funds to sponsor high risk ideas in robotics. In addition the effort will continue to sponsor efforts on roadmaps, summer schools, curricular developments, industrial links and dissemination.

Over the last few years' tremendous progress has been achieved in terms of coordinating the European research community and a sense of community has been established on par with what already existed in USA and Japan. In addition a number of interesting efforts has as collaborations across the involved countries. Finally a robotics programme on EU research has been initiated.

References:

H. I. Christensen, M. Hägele, R. Dillmann, A. Kazi and U.-G. Norefors, European Robotics, EURON-ERF Whitepaper, Stockholm, 2001.