LIENS - Laboratoire d'Informatique de l'ENS

Rapport Hcéres

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agence d'évaluation de la recherche
et de l'enseignement supérieur

Evaluation Report

Research unit :

LIENS

University : ENS - Paris

March 2009

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LIENS

University : ENS - Paris

Le Président
de l'AERES

Jean-François Dhainaut

Section des unités
de recherche

Le Directeur

Pierre Glorieux

Evaluation Report

The research unit :

Name of the research unit : LIENS

Requested label : UMR

N° in case of renewal : 8548

Head of the research unit : Mr. Jean VUILLEMIN

University or school :

ENS - Paris

Other institutions and research organizations:

CNRS

INRIA

Date(s) of the visit :

January 12, 2009

Members of the visiting committee

Chairman of the commitee :

Mr. Daniel HUTTENLOCHER, Cornell University, USA

Other committee members :

Mr. Jean GOUBAULT-LARRECQ, CNRS/INRIA

Mr. Arjen LENSTRA, Ecole Polytechnique Federal de Lausanne, Suisse

Mr. Marco ALJMONE MARSAN, Politecnico di Torino and IMDEA Networks, Italie

Mr. Guenter Rote, Freie Universitaet Berlin, Allemagne

CNU, CoNRS, CSS INSERM, représentant INRA, INRIA, IRD…..) representatives :

Mrs. Pascale LE GALL, for the CNU

Mr. Philippe Schnoebelen, CNRS, for the Comité National de la Recherche Scientifique

Mr. Sylvain Petitjean, LORIA/INRIA-Nancy, for INRIA

Observers

AERES scientific representative:

Mr. Luis FARIÑAS DEL CERRO

University or school representative :

Mr. Yves GULDNER

Research organization representative (s) :

Mr. Claude PUECH

Evaluation Report

1 • Short presentation of the research unit

- number of permanent researchers in lab: 26, number of non-permanent researchers in lab: 44
- numbers of "publishing" lab members : all
- numbers of HDR : 13
- numbers of lab members who have been granted a PEDR: 2
- numbers of PhD students who have obtained their PhD during the past 4 years : 27
- numbers of current PhD students: 32

LIENS is composed of seven research teams. Four of these teams, ABSTRACTION, CASCADE, TREC and WILLOW, are not only leaders nationally within France but also among the top groups in computer science in the world in their respective research areas. In addition the ODYSSEE group has had similarly high productivity and impact but is re-orienting more towards neuroscience. The two other groups are smaller, more focused, with good publication records. By any measure of scientific productivity and impact, overall LIENS is an outstanding laboratory. LIENS has also grown substantially during this review period, from a total of 69 personnel in 2005 to 81 at the end of 2008, with several positions still being filled.

2 • Preparation and execution of the visit

The visit was organized by LIENS and AERES. The technical presentations by the researchers were thorough. However the instructions to the committee were not made adequately clear before the visit, and there was some subsequent confusion as to the form that the written evaluation was to take which slowed down the process.

3 • Overall appreciation of the activity of the research unit, of its links with local, national and international partners

LIENS is currently composed of seven research groups (in the order that they were considered during the visit):

- Geometry, combinatorics and algorithms - GECOAL
- Artificial vision - WILLOW
- Mathematical and computational neuroscience - ODYSSEE
- Complexity and information morphology - CIM
- Cryptography - CASCADE
- Abstract interpretation and semantics - ABSTRACTION
- Theory of networks and communication – TREC

Four of these research groups (ABSTRACTION, CASCADE, TREC and WILLOW) are international leaders; among a handful of the most productive, high impact and visible groups in the world in their respective research areas within computer science. The ABSTRACTION team is a leader in the area of programming language semantics, and also highly visible within the broader programming languages community. The CASCADE team is a leader in the area of cryptography, with broad scope that includes both the more theoretical and more applied areas of the field. The TREC team is a leader in the area of stochastic modeling of computer networks, which is an important sub-area in the networking field. The WILLOW team, while a very recent addition to the lab, is a leader in computer vision, with broad scope that includes more theoretical and applied areas of the field. WILLOW also has rapidly increasing impact in machine learning.

The ODYSSEE project has the high level of scientific excellence of these international leaders, but is currently re-orienting itself more towards mathematical and computational neuroscience an area that the review committee finds highly exciting but does not have all the necessary scientific background to assess. The GECOAL project has a high degree of scientific accomplishment, but is relatively narrow in its focus within the area of computational geometry. Thus while GECOAL is a well respected group, its scope limits its ability to become an international leader. The CIM project is another smaller team, which has a reasonable level of activity given its size, but is not in the position of a national or international leader. An additional challenge for evaluating CIM is that the work of the team does not fall into a broadly recognized area of computer science as the work of the other teams does, thus the committee was not able to evaluate this work in the same way as for the other teams.

4 • Specific appreciation team by team and/or project by project

4.1 GECOAL

GECOAL is a small team whose research focus is within discrete and computational geometry. In accordance with the team's size the research focus is somewhat narrow. The research team is visible within the international research community but not among the top players. Within the more restricted subfield of computational topology, members of the team are networked with the best groups worldwide. With respect to broadening the horizon, the research plan presented for 2009-2013 is heading in a good direction. The work spans the whole range from theoretical (structural) foundations, to the design and analysis of algorithms, all the way to the (occasional) development of software that is made available to CGAL (the Computational Geometry Algorithms Library) and marketed to potential users by GeometryFactory.

While the work of the group is not of high quantity it is however of high quality. Some of the work (on double pseudoline arrangements) is rather deep and of a foundational nature, and one would underrate the work by merely counting publications output.

<u>Strong points</u> :

The work of the group is of high quality ; some of the work (on double pseudoline arrangements) is rather deep and of a foundational nature.

<u>Weak points</u> :

The visibility of the group is not at the level of an international leader, partly because of its size and output.

<u>Recommendations</u> :

Visibility of the group might be improved by putting effort into making the results more accessible and on "popularizing" and advertising their significance. For instance, the team's presentation during the site visit left the impression of understatement about the achievements that have been obtained. Perhaps the team could be involved in organizing a major workshop like the European Workshop on Computational Geometry to help address the issue of visibility. The group would also benefit from a clearer vision for the future and strategic direction as well as articulation of that vision and direction

4.2 WILLOW

Willow focuses on representational issues in object recognition and scene understanding. It is a recent team at LIENS that did not exist at the time of the last evaluation, created as a result of the recruitment of its team leader by ENS.

In less than two years of existence, Willow has established itself as a leading force in the (already strong) national computer vision scene in France and a key player at the world level. This is due in no small part to the aura of its leaders, who are well-established and internationally renowned researchers. But it certainly extends well beyond that. Willow has succeeded in recruiting very promising young researchers and attracting bright PhD candidates. Overall, J. Ponce has assembled an impressive roster in such a short period of time.

In terms of publications in high-standard conferences and journals, the members of Willow have an excellent track record. Some of the young guns even have an outstanding publication record and clearly have the potential to become stars. It is also worth noting that the team has not grown in isolation. Indeed it has been very active (and successful) in establishing strong partnerships in Europe, both with academic and industrial partners.

The team leader appears to have a clear vision of the future. Over the past decade, statistical and machine learning techniques have moved into a central role in the fields of object recognition and computer vision. Accordingly, a significant part of the proposed research plan is dedicated to statistical characterizations of visual problems and effective learning. This is in line with the recruitments of F. Bach (INRIA, 2007) and S. Arlot (CNRS, 2008), the latter being a mathematician. The team has also started discussing with the statistics team in the maths department at ENS (DMA). This cross-fertilization could certainly lead to deep results and have a high impact in computer vision. Willow also collaborates with researchers of the cognition department (DEC) on matters related to visual perception. It should be praised for its active interactions with other disciplines in its immediate environment (in addition to strong ties with other computer vision researchers in France at INRIA-Grenoble and in other countries).

Strong points :

Willow is a proactive and dynamic research team with an excellent international research profile. It should be encouraged and supported by ENS, CNRS and INRIA as it has been over the past years (the very positive impact of INRIA was emphasized by the team leader).

Weak points :

No aspects were of concern, however the committee would like to underscore that growing too fast can be harmful. It can lead to dissipated efforts and resources, and lack of focus in research activity. The team leader is encouraged to have a clear strategy for future recruitments. He has already indicated that he is aware of the issue by hinting that the team may eventually split into two, one focusing on core vision issues, the other on machine learning techniques.

Recommendations :

Impact and visibility of research carried out by Willow members, while already high, could be further improved by emphasizing a policy of open, robust and reusable software that is publicly distributed. Team members are also encouraged to participate in international efforts for comparing and evaluating the quality of proposed approaches

4.3 ODYSSEE

The Odyssee team located both at ENS Paris and at Sophia Antipolis was split on January 2009 into two teams, one still under the name Odyssee located at Sophia Antipolis, and the new one both located at ENS and at Sophia Antipolis under the acronym NeuroMathComp, standing for Mathematical and Computational Neuroscience. The main objective of NeuroMathComp is to propose a mathematical and computational framework of visual information processing based on simulation techniques of neural networks and then to validate or refute the framework to biological and computer vision. This represents a very exciting challenge, which naturally results from the recent evolution of the Odyssee team from the classical computer vision to computational neurosciences.

The project's research efforts cover the study of neurons by means of in vitro and in vivo intracellular recordings provided with a computational model of electrodes, simulation techniques of neural networks,

models of deterministic/stochastic dynamics of single neurons and/or neuron populations. The works have been validated by a simulation tool and high-level quality publications either in computer science or in neurophysiology.

The ultimate goal is the definition of a unifying hierarchical model from a basic constituent, the spiking neuron, to assemblies of neurons hierarchically organized to cope with the complexity of a complete visual system. Olivier Faugeras, the leader of the team, is a very active and outstanding researcher. He has already demonstrated his capacity of leading a visionary project about 3D computer vision and over the past several years has redirected his work and that of the team towards the use of neural networks to better understand vision mechanisms. The recent publications of the group show clear evidence of the initial success of this new direction. Moreover, the research project NerVi planned between 2009 and 2014 and recently having received significant funding represents an outstanding opportunity to develop the ambitious goal of the Odyssee team.

<u>Strong points</u> :

This project has excellent potential and a history of strong accomplishments. The recent publications of the group show clear evidence of the initial success of the team's new direction. Moreover, the research project NerVi planned between 2009 and 2014 and recently having received significant funding represents an outstanding opportunity.

<u>Weak points</u> :

Nonetheless the large change in direction is not without risks. It is critical that this project be reviewed by neurophysiologists and not only computer scientists.

<u>Recommendations</u> :

We encourage the team to continue pursuing strong external collaborations particularly with neurophysiologists.

4.4 CIM

The CIM team was started in 2002, and consists of a single senior CNRS researcher with his doctoral students and the occasional post-doctoral researcher or foreign visitor. The scientific objectives are theoretical and of an epistemic nature, aiming at bridging Computation, Physics and Biology. Investigated questions include the different nature of randomness in the three fields, and organization in biological systems seen from a complexity-theoretic viewpoint.

This committee is ill-equipped to evaluate the pertinence of this research agenda, or the partial achievements that have been presented during the visit, as they lie largely outside of computer science. However, it is clear that the group is active, has a considerable output of publications, and is involved in high-level pluridisciplinary collaborations that fit its stated agenda.

The review committee does not feel capable of evaluating the strengths and weakeness or making suggestions regarding this project, as so much of the work lies outside the domain of computer science.

4.5 CASCADE

This team continues its excellent performance. It covers a wide spectrum of cryptologic activities ranging from foundational work in geometry of numbers, design of cryptographic protocols with provable properties, and innovative privacy and anonymity preserving techniques, to cryptanalysis of actual cryptographic primitives, and the design of very fast hardware. In particular the combination of intricate mathematical insights and practical analysis involving both software and hardware is impressive. The visibility created by the team, with respect to collaborations, number of publications and theses, etc., is exemplary. The work of the team is constantly represented at all major cryptologic conferences world-wide, and its members figure prominently in the international cryptographic community: the team is the uncontested leader of cryptographic research in France and counts among the world's top research groups in cryptology.

Strong points :

To maintain its prominent position, the team may be expected to engage not just in research that is relevant from a current cryptologic point of view, but foremost in forward-looking academically challenging research that recognizes and, more importantly, pro-actively defines new trends in the field. The team's plan to study the cryptanalytic impact of relatively inexpensive commodity hardware is an excellent first step in this direction.

Weak points :

Despite the strength of the team and its outstanding international research profile, after the departure of Jacques Stern there is considerable risk for the future.

Recommendations :

We advise that the leadership of the team focus on this issue in order to help minimize its impact on the research and visibility of the group. For instance, there is good potential for broader impact with Naccache and more recently Vuillemin who both have valuable industrial background and contacts.

4.6 ABSTRACTION

The Abstraction team is one of the world-leading teams in its domain, centered around abstract interpretation and efficient static analysis of large-scale programs. The members of the team have an excellent record of international quality publications, but perhaps more remarkably, an impressive record of successful and active collaborations with industry. The ASTREE program is a very impressive piece of software, and the only static analyzer to-date that manages to analyze actual 100 kLOC plus code without false positives. This required the participation of most, if not all, members of the project.

Such a piece of software must, definitely, be industrialized. This is required for dissemination, and also for making this piece of software perennial. This committee is pleased to see that all efforts are being made to this end, in particular through discussions with AbsInt angew Informatik.

The success of ASTREE and of related research work in the team may hide the fact that Abstraction has a wider scope. This is witnessed by works in areas such as computer security and systems biology. In static analysis of software, the team must be able to free itself of ASTREE, at least partly, to make room for further research. The fact that AbsInt would take the task of maintaining and upholding ASTREE on the one hand, and the various other contracts the team has, indicate that the team is on the right track.

As far as publications are concerned, as said above, the team achieves a high number of publications in excellent conferences and journals. This is remarkable, even without considering that they have actively created or participated in successful software projects (ProVerif/CryptoVerif, ASTREE).

Strong points :

An excellent combination of high publication productivity and impact together with development and distribution of widely used software.

Weak points :

The team currently has relatively few students (3 PhD students, all nearing completion, and one intern). This is a problem that should be addressed quickly. The team leader is aware of this, and he can only be encouraged to cure it. One way would be to hire more students from outside ENS, in or outside France. Moreover, most of the students who defended their PhD's in the Abstraction team during the evaluation period, except for two (Ch. Hymans, F. Logozzo), are now working in Abstraction, whereas it would be advisable to have some, or even most of them, apply to other teams in France or abroad.

Recommendations :

The committee would like to recommend the team to improve its vision of the future. The current prospective themes that Abstraction would like to concentrate upon are: 1. improving and extending ASTREE, 2. defining new abstract domains, 3. designing better static analyses for concurrent programs, 4. verification of security protocols, and 5. analysis of quantitative or semi-quantitative properties in systems biology. While all these goals are very important and desirable, they are primarily the continuation of already existing activities. On

the one hand, this is a good point: these are the domains in which the team excels. On the other hand, a vision would help lead the team along a clear path, and avoid unneeded dispersion across research themes, something that the team is now risking

4.7 TREC

During the past few years, the TREC team has played a leading role in the field of networking, becoming one of the world references in the important area of stochastic modeling of computer networks. Prof. Francois Baccelli, together with his team and his doctoral students, has developed groundbreaking theories, opening new directions for research.

Most notably, a number of the doctoral students of Professor Baccelli after graduating have continued to produce extremely relevant contributions in the groups that they have joined around the world, thus very significantly contributing to the global advancement of research in the area of networking as well as to the visibility of the TREC project.

The publication record of the team is highly impressive. Papers of the group have appeared in the leading and most selective journals of the field, such as Annals of Applied Probability (5 papers), Advances in Applied Probability (3 papers), Journal of Applied Probability (2), Stochastic Models, Queuing Systems (5 papers), Performance Evaluation, ACM/IEEE Transactions on Networking (2), Information Theory (2), and others. The same is true for the most selective conferences, in particular SIGCOMM and INFOCOM. Most striking is the fact that the team has published 16 papers at INFOCOM over the past 4 years (one of the most selective conferences in the field, with acceptance rates of less than 20%, which this year received over 1400 submission).

The team also has substantial outside collaborations, with an excellent record of successful and active collaborations with important industries in the networking field, such as Alcatel, IBM, Sprint and Thomson. The team has also significantly contributed to higher education, with courses at all levels, from undergraduate, to graduate, to very specialized doctoral courses, taught both in France and abroad.

<u>Strong points</u> :

The excellence of the overall activities of the group earned several outstanding recognitions for Professor Baccelli. He held the Eurandom Chair in 2004-2005, and he was elected to the French Academy of Sciences in 2005.

<u>Weak points</u> :

The only weak point of the group seems to be in its limited size. It seems a pity that such a creative group, which is having a huge impact on networking research given its size, cannot reach critical mass.

<u>Recommendations</u> :

The committee would like to recommend that a special effort is made to increase the size of the team by recruiting additional permanent staff. As regards future research plans, the committee would like to suggest that the research group, in addition to continuing activities in areas that have been so remarkably successful in the past, especially if new members will be recruited, also consider new emerging topics, such as energy efficient networking, where the competences of the team could produce groundbreaking results.

5 • Appreciation of resources and of the life of the research unit

The laboratory has four remarkably productive and high impact groups that are not only leaders nationally within France but also among the top groups in computer science in the world in their respective research areas. In addition one group has had similarly high productivity and impact but is re-orienting more towards neuroscience, and two other groups are smaller more focused with good publication records. By any measure of scientific productivity and impact, overall LIENS is an outstanding laboratory.

Each team finds its partners primarily among other institutes of ENS, other institutions in France, and colleagues abroad, only occasionally forming ties with other teams of LIENS. Researchwise, LIENS is more an agglomeration of teams that is held together by common administrative bonds (and the organization of the curriculum in the Departement d'Informatique). Although we find this structure uncommon, we do not see it as a problematic issue, after reviewing the teams. It allows each team to flourish independently. However we were left with the distinct impression that the relative lack of scientific collaboration and coordination among the teams, while not a problem, could well be a missed opportunity. We encourage the research teams to pursue more of a common laboratory culture. For instance, seminars and other shared activities between the research teams would benefit the students doing their theses in the laboratory, and potentially also the junior students who are still primarily taking classes at ENS.

The review team found the support from ENS for both space and resources to be unacceptably weak, particularly given the excellence and importance of the research being performed. In the past few decades computer science has become a critical scientific field, both intellectually and in terms of potential for economic development. Yet the view of the ENS administration seems to be that this is some small and not very important area of study, at least based on the level of resources that are provided by the school.

In terms of resources, first and foremost the space is totally inadequate for the scale of research projects in the laboratory. Current plans seem to call for leasing space in an office building and moving one or more of the teams off campus, but this will only contribute to the lack of a laboratory-wide culture. We believe that it is highly important that adequate space be found to place the entire laboratory together and within close proximity to the rest of ENS so that students can easily get between the laboratory and other classes and activities.

There has recently been apparent improvement for support of the research within the laboratory with the creation of a joint ENS-CNRS-INRIA partnership. The review committee highly applauds this and believes that the resulting increased support of the projects is more than warranted. However this joint laboratory brings with it the risk of increased bureaucracy, and the possibility of turf battles between CNRS and INRIA. It will be very important for all three organizations to work together to support the scientific excellence of the existing teams, as well as additional teams. It is also important that in this partnership ENS provide more space and other resources (such as administrative support) appropriate to the level of funding and activity of the other partners.

The structure of LIENS seems to have grown historically not as a result of conscious and coherent planning, but rather from the effort to attract the best people whenever they are available, or to start a new team during a time window of fortunate political and administrative circumstances. It is important to develop a strategic plan for the areas that LIENS will develop and hire into. For instance, the recent hiring of the WILLOW teamleader was excellent in terms of the research reputation, research caliber, and high level of activity of his team. Coordinated actions of this kind have the potential to elevate French computer science research to a higher position on the international stage. The UK, Switzerland and Germany have all been investing heavily in computer science in the past decade, which has been less evident in France, particularly in French universities.

5.1 ADMINISTRATIVE AND TECHNICAL SUPPORT

The support team appears to work well despite being somewhat understaffed, and the researchers seem aware of and happy with the efforts of the staff.

It is for instance remarkable that the computer facilities are run successfully by a team of only 4 people, while being shared by both the computer science and mathematics departments.

Additional stress is placed on the small technical team by the lack of coordination and sharing of infrastructure. In effect each team makes separate purchasing decisions and then turns to the shared technical support staff after equipment arrives and needs to be installed.

The support staff appears to have considerable personal investment in their jobs, but with few paths for reward. In particular the possibilities of promotions are scarce.

The increased level of INRIA support is perceived very positively by all the researchers and also by the review committee, but this is not necessarily the case among the support staff, for whom it is an additional burden. It

raises many issues, including: (i) different working modes in different organizations, (ii) different information systems (on top of those of ENS and CNRS), (iii) complex organization, such as INRIA administrative personnel being placed under the INRIA team leaders rather than the support head, (iv) increased difficulty of forming a global view of budget and resource issues.

6 ● Recommendations and advice

<u>Strong points</u> :

Overall the scientific excellence is absolutely first rate, and the teams are very attractive to students and researchers alike. The laboratory has four remarkably productive and high impact groups (ABSTRACTION, CASCADE, TREC and WILLOW) that are not only leaders nationally within France but also among the top groups in computer science in the world in their respective research areas. In addition the ODYSSEE group has had similarly high productivity and impact but is re-orienting more towards neuroscience. The two other groups are smaller more focused with good publication records. By any measure of scientific productivity and impact, overall LIENS is an outstanding laboratory.

<u>Weak points</u> :

Our overall assessment of the laboratory is lowered by the fact that it is the individual teams themselves that achieve this scientific excellence, with relatively little support from the school (ENS) or from an overall laboratory culture rather than separate teams.

<u>Recommendations</u> :

It is highly important that adequate space be found to place the entire laboratory together and within close proximity to the rest of ENS so that students can easily get between the laboratory and other classes and activities (current plans for an off-campus site are not ideal in this regard, due to distance to the remainder of the lab and the campus).

It is important to develop a strategic plan overall for the areas that LIENS will develop and hire into. For instance, the recent creation of the WILLOW team was excellent in terms of the research reputation, research caliber, and high level of activity of his team. Coordinated actions of this kind, at an educational institution of the caliber of ENS, have the potential to elevate French computer science research to a higher position on the international stage.

Note de l'unité	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Stratégie, gouvernance et vie du laboratoire	Appréciation du projet
A+	A+	A+	B	A

Dear Visiting Committee,

First and foremost, I want to thank the visiting committee for the time and efforts spent in evaluating LIENS (Laboratoire d'Informatique de l'ENS).

For LIENS, this was the first overall evaluation, as opposed to separate evaluations of its CNRS and INRIA research groups. The visit was aptly driven by Luis FARIÑAS DEL CERRO from AERES, who put together an impressive evaluation panel, with strong international competence in the key research areas at LIENS. The report is sharp and focused, the recommendations made are well received, and we will follow suit in trying to implement them.

There are nevertheless two points in the report on which I like to dissent.

1. Regarding the re-orientation of Odyssee into NeuroMathComp, the report states: "Nonetheless the large change in direction is not without risks. It is critical that this project be reviewed by neurophysiologists and not only computer scientists." I plead guilty for not foreseeing the lack of neurophysiologist in the expert panel. I want to express LIENS full support for this change in scientific focus. If LIENS does not take and support scientific risk, who in France will? Indeed, the large ERC grant which Faugeras has obtained shows that other responsible people share this view.
2. Regarding the CIM project, there is a significant discrepancy between the report summary "The CIM project is another smaller team, which has a reasonable level of activity given its size, but is not in the position of a national or international leader" and the core of the report "However, it is clear that the group is active, has a considerable output of publications, and is involved in high-level pluridisciplinary collaborations that fit its stated agenda." Since "the review committee does not feel capable of evaluating the strengths and weakeness or making suggestions regarding this project" I think that it would be fair for all to change the summary sentence quoted above, in a way which is consistent with the detailed comments. Here again, LIENS re-iterates its support for scientific risk taking and inter-disciplinary ventures which fit the local culture and capitalize on the ENS environment, well beyond strict computer science.

During the visit, I have also expressed the view that education and training are inherent parts of our school mission, and that they should be evaluated together with our research, rather than artificially separated as currently planned.

All this said, I want to personnaly thank again all our visitors for their superb handling of a difficult task.
A last personal comment is that I regard this unified evaluation of research at LIENS by AERES as a big step forward, compared to the previously in place national practices.

Jean Vuillemin

Chairman of Computer Science at ENS.