

# CURRICULUM VITAE

(Last updated: November 3, 2011)

## PERSONAL DATA

*Name:* **Petar Kormushev**  
*Nationality:* Bulgaria  
*Age:* 31  
*Civil status:* married, one child  
*Personal website:* [<http://kormushev.com>]  
*E-mail:* [petar@kormushev.com](mailto:petar@kormushev.com)  
*LinkedIn profile:* [[www.linkedin.com/in/petarkormushev](http://www.linkedin.com/in/petarkormushev)]



## CURRENT JOB

*Position:* Team Leader (US equivalent: Assistant Professor)  
*Employer:* Department of Advanced Robotics, Italian Institute of Technology (IIT)  
*Since:* November, 2011  
*Research interests:* Robotics, machine learning, computational intelligence

## EDUCATION

2009, Sep	Ph.D. in Computational Intelligence	Tokyo Institute of Technology
2006 (GPA 6.0/6.0)	M.Sc. in Bio- and Medical Informatics	Sofia University
2005 (GPA 6.0/6.0)	M.Sc. in Artificial Intelligence	Sofia University
2003 (GPA 5.8/6.0)	B.Sc. in Computer Science	Sofia University

## WORK EXPERIENCE

2009 ~ 2011 (2 years)	Italian Institute of Technology, Senior Post Doc	<a href="http://www.iit.it">www.iit.it</a>
2008 ~ 2008 (3 months)	Google, Software Engineering intern (Google Japan)	<a href="http://www.google.com">www.google.com</a>
2000 ~ 2006 (6 years)	Kontrax, Software Project Manager	<a href="http://www.kontrax.bg">www.kontrax.bg</a>
1999 ~ 2000 (1 year)	Power Partner, Software Engineer	<a href="http://www.ppartner.com">www.ppartner.com</a>

## AWARDS

2006 ~ 2009 **Doctoral Research Fellowship**  
Awarded by the Japanese Government (MEXT/Monbukagakusho) for 4 years, to pursue my PhD degree

2005 **The “St. Kliment Ohridski” Award**  
Awarded by the President of Sofia University, for exceptional academic achievements and extracurricular activities

2002 **The “John Atanasoff” Award**  
Awarded by Eureka Foundation for outstanding achievements in Computer Science [[www.evrika.org](http://www.evrika.org)]. The award was devoted to the 100th birthday of John Atanasoff – the inventor of the first electronic digital computer.

## LANGUAGES

English - fluent	(Cambridge Certificate, TOEFL, SAT-I)
Bulgarian - fluent	(mother tongue)
Japanese - intermediate	(between JLPT-2 and JLPT-3)
Russian - beginner	
Italian - beginner	

## RESEARCH PROJECTS

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### 2012 ~ 2015 (4 years) [FP7 \(IP\) project STIFF-FLOP](#)

This is a collaborative project that was awarded to a consortium of **14** research institutions in Europe, among which is IIT. **I am the Technical Coordinator** of this project for IIT. My responsibilities include the scientific and technical/technological aspects of the project. The research topic is “STIFFness controllable Flexible and Learn-able manipulator for surgical OPERations”. The negotiations with EC have been finalized and we expect to receive funding and start working on the project by January 2012.

### 2012 ~ 2014 (3 years) [FP7 \(STREP\) project PANDORA](#)

This is a collaborative project that was awarded to a consortium of **5** research institutions in Europe, among which is IIT. **I am the Technical Coordinator** of this project for IIT. My responsibilities include the scientific and technical/technological aspects of the project. The research topic is “Persistent Autonomy through Learning, Adaptation, Observation and Re-planning”. The goal of the project is to create a fully autonomous underwater vehicle for conducting inspection and manipulation tasks. The negotiations with EC have been finalized and we expect to receive funding and start working on the project by January 2012.

### 2010 ~ 2011 (1 year) [Japanese-Italian Collaborative Project](#)

Due to my good academic connections with Japan, I managed to initiate a collaboration between a Japanese university (Tokyo City University) and IIT. I applied for funding within the Executive Programme of Cooperation in the field of Science and Technology between Japan and Italy for the years 2010-2011. My project proposal was on “Upper-body kinesthetic teaching of a free-standing humanoid robot” and was approved for funding by the Italian government. **IIT received travel funding** for exchange of researchers to conduct the proposed research. I worked at the Japanese partner’s laboratory in Tokyo and we successfully completed the project’s goals and published an ICRA 2011 paper with the results. Currently I am discussing with the Japanese partner a possible extension of our collaboration.

### 2006 ~ 2008 (3 years) [Japanese NEDO Project for Next-Generation Robots](#)

During my research period in Japan at Tokyo Institute of Technology, I participated in a NEDO project sponsored by the Japanese government, called “Development Project for a Common Basis of Next-Generation Robots”. The project leader was Prof. Kaoru Hirota from the Dept. of Computational Intelligence and Systems Science, Tokyo Institute of Technology. The goal of the project was to develop a framework for natural communication between robots and humans by including face expressions and emotions generated in an affinity pleasure-arousal space of mental states. We conducted experiments with different prototypes of an eye-robot for emotion expression, and with a speech recognition module. During the project, I collaborated with Prof. Kohei Nomoto from Mitsubishi Electric Corp. and Prof. Shigeaki Sakurai from Toshiba Corp. [[www.nedo.go.jp/activities/portal/p05027.html](http://www.nedo.go.jp/activities/portal/p05027.html)]

### 2006 ~ 2009 (4 years) [Japanese Research Fellowship](#)

After submitting a research proposal and passing multiple rounds of selection, I was awarded a research fellowship by the Japanese Government (MEXT/Monbukagakusho). I received funding of around **70,000 EUR** and conducted research at Tokyo Institute of Technology in Japan.

### 2004 ~ 2006 (2 years) [FP6 EC project INFRAWEBS](#)

I participated in this ICT project for developing the future Semantic Web. I worked on formal logical implementation of Semantic Web Services. My research was supervised by Prof. Gennady Agre from the Institute of Information Technologies at the Bulgarian Academy of Sciences. We created a visual

ontology-driven tool for construction of complex WSML logical expressions, to be used as capability descriptors of Semantic Web Services.

## PUBLICATIONS

- [1] Kormushev, P., Ugurlu, B., Calinon, S., Tsagarakis, N., and Caldwell, D.G., “Bipedal Walking Energy Minimization by Reinforcement Learning”, IROS-2011, pp. 318-324, San Francisco, September, 2011.
- [2] Kormushev, P., Nenchev, D.N., Calinon, S., and Caldwell, D.G., ”Upper-body Kinesthetic Teaching of a Free-standing Humanoid Robot“, IEEE Intl. Conf. on Robotics and Automation (ICRA 2011), pp. 3970-3975, 2011.
- [3] Kormushev, P., Calinon, S., and Caldwell, D.G., “Imitation learning of positional and force skills demonstrated via kinesthetic teaching and haptic input”, *Advanced Robotics*, Vol. 25, pp. 581-603, 2011.
- [4] Sato, F., Nishii, T., Takahashi, J., Yoshida, Y., Mitsuhashi, M., Kormushev, P., Kanamiya, Y., “Whiteboard Cleaning Task Realization with HOAP-2”, Proc. SICE System Integration (SI-2010) in Sendai, Japan, pp.426-429, 2010.
- [5] Kormushev, P., Calinon, S., and Caldwell, D.G., “Approaches for Learning Human-like Motor Skills which Require Variable Stiffness During Execution”, Workshop on Humanoid Robots Learning from Human Interaction (at Humanoids 2010), 2010.
- [6] Kormushev, P., Calinon, S., Saegusa, R. and Metta, G., “Learning the skill of archery by a humanoid robot iCub”, Proc. IEEE Intl Conf. on Humanoid Robots (Humanoids-2010), pp. 417-423, 2010.
- [7] Kormushev, P., Calinon, S. and Caldwell, D.G. “Robot Motor Skill Coordination with EM-based Reinforcement Learning”, Proc. IEEE/RSJ Intl Conf. on Intelligent Robots and Systems (IROS-2010), 2010.
- [8] Kormushev, P., PhD thesis: “Time Hopping Technique for Reinforcement Learning and its Application to Robot Control”, *Dept. of Computational Intelligence and Systems Science, Tokyo Institute of Technology*, September, 2009.
- [9] Kormushev, P., Dong, F., and Hirota, K., “Probability redistribution using time hopping for reinforcement learning”, *10th International Symposium on Advanced Intelligent Systems ISIS-2009*, 2009.
- [10] Kormushev, P., Nomoto, K., Dong, F., and Hirota, K., “Eligibility propagation to speed up time hopping for reinforcement learning”, *Journal of Advanced Computational Intelligence and Intelligent Informatics*, Vol.13, No.6, 2009.
- [11] Kormushev, P., Nomoto, K., Dong, F., and Hirota, K., “Time manipulation technique for speeding up reinforcement learning in simulations”, *International Journal of Cybernetics and Information Technologies*, Vol. 8, No. 1, pp. 12-24, January, 2008.
- [12] Yamazaki, Y., Dong, F., Masuda, Y., Uehara, Y., Kormushev, P., Vu, H. A., Le, P. Q., and Hirota, K., “Intent expression using eye robot for mascot robot system”, *8th International Symposium on Advanced Intelligent Systems ISIS-2007*, 2007.
- [13] Yamazaki, Y., Dong, F., Masuda, Y., Uehara, Y., Kormushev, P., Vu, H. A., Le, P. Q., and Hirota, K., “Fuzzy inference based mentality estimation for eye robot agent”, *Proceedings of 23rd Fuzzy System Symposium FSS-2007*, 2007.

- [14] Agre, G., Kormushev, P. and Dilov, I., “INFRAWEBs Axiom editor – a graphical ontology-driven tool for creating complex logical expressions”, *International Journal of Information Theories and Applications*, Vol. 13, No. 2, pp. 169-178, November, 2006.
- [15] Kormushev, P., Master's thesis: “Visual approach for data mining on medical information databases using Fastmap algorithm”, *Faculty of Mathematics and Informatics, Sofia University*, March, 2006.
- [16] Kormushev, P., Master's thesis: “Design, development and implementation of a tool for construction of declarative functional descriptions of semantic web services based on WSMO methodology”, *Faculty of Mathematics and Informatics, Sofia University*, July, 2005.
- [17] Agre, G., Kormushev, P. and Dilov, I., “INFRAWEBs Capability editor – A graphical ontology-driven tool for creating capabilities of Semantic Web Services”, *Third International Conference on Information Research, Applications and Education i.TECH-2005*, June, 2005.

More information about my research is available on my website: [<http://kormushev.com/research/>]

## RESEARCH TOPICS

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### Robot learning and interaction

Since 2009, I am a member of the “Robot learning and interaction” group at the Advanced Robotics department of the Italian Institute of Technology. My supervisor is Prof. Darwin G. Caldwell and I work together with Dr. Sylvain Calinon and a group of excellent PhD students. I have been doing research on imitation learning and reinforcement learning algorithms, as well as on human-robot interaction. For my experiments, I am using the compliant humanoid robot COMAN, the humanoid robot iCub, the robot manipulator Barrett WAM, the small humanoid Fujitsu HOAP-2, the motion capture systems Vicon and OptiTrack, and the Omega-7 haptic device. More information about my research, including videos of my robot experiments are available at: [<http://kormushev.com/research/videos/>]

### Robotics and Human-Robot Interaction

From April 2006 until September 2009 (3.5 years), I was doing PhD research in robotics and machine learning in the laboratory of Prof. Kaoru Hirota at the Department of Computational Intelligence and Systems Science, Tokyo Institute of Technology. [[www.hrt.dis.titech.ac.jp](http://www.hrt.dis.titech.ac.jp)]

In 2006 and 2007, I participated in a NEDO project sponsored by the Japanese government, called “Development Project for a Common Basis of Next-Generation Robots”, with Prof. Hirota as a project leader. The goal of the project was to develop a framework for natural communication between robots and humans by including face expressions and emotions generated in an affinity pleasure-arousal space of mental states. We conducted experiments with different prototypes of an eye-robot for emotion expression and with a speech recognition module. [[www.nedo.go.jp/activities/portal/p05027.html](http://www.nedo.go.jp/activities/portal/p05027.html)]

### Computational Intelligence for Robot learning

In addition to Prof. Kaoru Hirota's supervision, from 2007 until 2009 I have been under the direct supervision of visiting Prof. Kohei Nomoto, from Industrial Design Center, Mitsubishi Electric Corp., Tokyo [[www.dis.titech.ac.jp/staff/nomoto.html](http://www.dis.titech.ac.jp/staff/nomoto.html)].

My main PhD research is focused on machine learning approaches for robot intelligence, with preference to reinforcement learning algorithms. Under Prof. Nomoto's supervision, I proposed a novel approach for speeding up the learning process in computer simulations, utilizing previously unused properties of simulations (like non-linearity of time and possibility of direct jumps between distant states). Based on this approach, I created two reinforcement learning techniques, the so called time manipulation and time hopping techniques, which substantially increase the learning speed (more than 6 times). To further improve these techniques, I proposed another algorithm, called eligibility propagation, which improves the state update process and also shows extremely promising results.

### Machine Learning and Query Classification

In the summer of 2008, during my internship at Google Japan, I did research on Machine Learning with the purpose of automated search query classification. I developed an algorithm which uses search context vectors and various similarity measures to do classification of the search queries entered at the Google

search engine. The prototype implementation of my algorithm is still used internally by the Search Quality team and the YouTube team in Google Japan.

### Semantic Web and Semantic Web Services

From 2004 to 2005, I was doing research on the future model of the current Web, called the Semantic Web. I was under the supervision of Prof. Gennady Agre from the Institute of Information Technologies at the Bulgarian Academy of Sciences [[www.iit.bas.bg/staff\\_en/g\\_agre2.html](http://www.iit.bas.bg/staff_en/g_agre2.html)]. We were participating in a European Union-sponsored FP6 research framework and did research on a key element of the Semantic Web technology: the so called Semantic Web Services. As a result of our research, we created a visual ontology-driven tool for construction of complex WSMML logical expressions, to be used as capabilities of semantic web services. The name of the project is INFRAWEBs and our tool is included in the official Semantic Web framework. [[www.infraweb.eu](http://www.infraweb.eu)]

### Bio-Medical Informatics and Data Mining

From 2005 to 2006, I did research on Medical Data Mining under the supervision of Prof. Antony Popov at the Faculty of Mathematics and Informatics, Sofia University. I created a software application for visualization of multi-dimensional medical data in a convenient way for medical doctors to analyze. My research was focused on dimensionality reduction algorithms, such as the FastMap algorithm.

## PROGRAMMING SKILLS

### Programming Languages

Procedural	Java, C/C++, C# .NET, MATLAB, Delphi, VB, Python, Assembler
Logical	Prolog (ARITY, Strawberry, SWI)
Functional	Scheme (TI Scheme), LISP
Database	ANSI SQL-92
Web	PHP, JSP, ASP, JavaScript
Markup	HTML, DHTML, CSS, XML, XSL/XSLT

### Programming Platforms

IDE	Eclipse, MS Visual Studio .NET, Borland JBuilder, IntelliJ IDEA, Delphi / Kylix, Together, C++Builder, Free Pascal
OS	Windows, Linux, Mac OS, Palm OS, MS-DOS
RDBMS	MS SQL Server, Oracle, Borland InterBase, MySQL
Version Control	Perforce, GIT, SVN, MS Visual SourceSafe, Borland StarTeam, Team Source
Modeling	ERWin, Poseidon (ArgoUML), MS Visio
Bug-tracking	Mantis

### Software Technologies

Data Access	ODBC, JDBC, ADO, BDE
Database Programming	Multi-tier architecture, Borland DataSnap, MIDAS, Briefcase model
Internet Protocols	TCP/IP protocols, RADIUS
Distributed Applications	RMI, DCOM, TCP/IP Sockets
Windows Programming	Win32 API, COM, ActiveX
Sound	DirectSound (Win), low-level Sound Blaster programming
Graphics	DirectX SDK programming with MS Visual Studio
System programming	Windows API, ASM for 80x86, MS-DOS system functions, IRQ-s
Compiler creation	lex and yacc tools, compiler theory
Parallel Programming	MPI (Message Passing Interface)
Virtualization	MS Virtual PC, VMware Server, Xen, Sandboxie, KVM

### Computer Science theory

Algorithm design and analysis, computational complexity, discrete mathematics, advanced data structures (hash tables, graphs, B-trees, suffix trees, red-black trees, Fibonacci heap, etc.), design patterns, NLP, cryptography (security, PKI, etc.), computational geometry, graph theory, max-flow algorithms, machine learning algorithms, neural networks, classifiers, pattern recognition, signal processing, MDP, dynamic programming, greedy algorithms, data mining, knowledge-based systems, expert systems, genetic

algorithms, object-oriented programming, software lifecycle, client-server technology, multi-tier architecture, multithreading and thread synchronization, database theory, relational database design, network protocols, and many others.

## COMPANY EXPERIENCE

### Software Engineer

Software engineering division of Google Japan [[www.google.co.jp](http://www.google.co.jp)]

At Google I worked as a software engineer in the Search Quality team. It was a unique experience for me to get familiar with the software infrastructure and technologies used in Google. I had access to and used the same source codebase, OS, IDE, VCS, DB, Borg, MapReduce clusters and etc. as all software engineers in Google. The goal of my internship was to create automated search query classification. I implemented a prototype of a new search query processing system using machine learning algorithms. My prototype used search context vectors and various similarity measures to do classification of the search queries entered at the Google search engine. The core implementation of my algorithm is still used internally by the Search Quality team and the YouTube team in Google Japan.

### Software Project Manager

Software division of Kontrax [[www.kontrax.bg](http://www.kontrax.bg)] - (6 years)

I worked at Kontrax for 6 years, starting as a junior software developer, later a senior developer and in the end - Software Project Manager. By 2006, I was responsible for most of the software projects of the company and managed about 15 subordinate employees. I had experience with various programming languages, technologies, methodologies, network and database administration, quality assurance, project management and so on. I have worked on more than 20 software projects, ranging from a simple online web shop to a big multi-tier distributed data warehouse system used by thousands of users. Some of our customers were big governmental institutions (like the National Health Insurance Agency), others - just smaller private companies. The duration of the projects was anywhere between 3 months and 4 years. The biggest project that I was managing was about 500,000 lines of source code. For a description of some of my projects, please refer to the section "Company Software Projects".

### Software Engineer

Software division of Power Partner [[www.ppartner.com](http://www.ppartner.com)] - (1 year)

Power Partner is the official partner of Borland for Bulgaria. Due to this, I had the opportunity to use most of Borland's software products, like IDE-s (Borland Together, JBuilder, C++Builder, Delphi, Team Source, StarTeam, InterBase RDBMS server, Kylix, etc.). I also was a software consultant for Power Partner's customers, giving expert advice about deploying and using various Borland products.

## CERTIFICATES



Microsoft Certified Professional, 2003

Successfully passed exam 070-316 "Developing and Implementing Windows-based Applications with Microsoft Visual C# .NET and Microsoft Visual Studio .NET"



Cisco Certified Network Associate, 2005

Passed CCNA exam 1 Networking Basics, final score 100%



BrainBench Certified Professional, 2002 ~ 2006

Certificates: C, C++, PHP, Delphi, WWW Concepts, Programmer/Analyst Aptitude



JAXA Space Science Program Certificate, AWS-2006

Successfully completed the 2006 AWS Space Science Program of JAXA at Tsukuba Space Center [[www.isas.ac.jp/home/winter\\_school/](http://www.isas.ac.jp/home/winter_school/)]



Member of MENSA International, 2005

Mensa is the biggest, oldest and most famous high-IQ society in the world.

## PROGRAMMING COMPETITIONS

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2004	IBM Research, “Ponder This” problem solving competition Solved the January 2004 challenge, [ <a href="http://www.research.ibm.com/ponder">www.research.ibm.com/ponder</a> ]
2001	3rd place in the Bulgarian National Programming Competition Organized by PC Magazine and Musala Soft [ <a href="http://konkurs.musala.com">http://konkurs.musala.com</a> ]
2000	5th place in the Bulgarian National Programming Competition Organized by PC Magazine Bulgaria
1999~2003	Regular participant in the FMI programming competitions, Organized by the Faculty of Mathematics and Informatics of Sofia Univ., under the supervision of Prof. Krasimir Manev, the coach of the Bulgarian National Programming Team, representing Bulgaria at IOI.
1997~1999	Regular participant in “Eureka” problem solving contest Published monthly in “Computer” magazine
1995~1999	Regular participant in the National Olympiad in Computer Science

## RECOMMENDATIONS

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I have 14 recommendations from former managers and co-workers, available online in LinkedIn at: [<http://www.linkedin.com/in/petarkormushev>]. In addition, I have 6 official recommendations (on paper, signed), which are available upon request. These are just excerpts of a few selected recommendations:

“I had the pleasure of hosting/mentoring Petar during his internship at Google Japan. During three months at Google, Petar methodically learned basic infrastructure and generated interesting ideas which resulted in significant improvement of the product he worked on. He provided energy and excitement and quickly made friends with other engineers.” December 20, 2008

--- [Slaven Bilac](#), *Software Engineer, managed Petar at Google*

“Petar demonstrated excellent software engineering skills during his internship at Google. He was able to deliver in a short time of period a working demo of a generic search query classifier. His humbleness and enthusiasm allowed him to quickly strike a conversation with other engineering teams and cross-pollinate ideas - a well appreciated quality at Google. I highly recommend Petar for his work and personality beyond work.” January 7, 2009

--- [Xinmei Cai](#), *Software Engineer, worked with Petar at Google*

“I know Petar from his starting working for Kontrax in 2000 till his leaving to Japan in 2007 for his specialization. In fact he has built the software department in the company, which counts to more than 20 developers today. Petar is extremely talented person, who combines both professionalism and capabilities to organize and manage teams. Also being one of the smartest people I know, reliable partner and a good friend at the same time.” April 23, 2009

--- [Jordan Jordanov](#), *Owner of Kontrax, managed Petar indirectly at Kontrax*

“I have known Petar Kormushev since 1999 when he joined Kontrax as a young specialist. During the following 7 years he grew in experience and made an astonishing progress in his career. He worked his way up to the position of Software Project manager. I can always rely on his sound decisions and professional attitude to work. Petar has university degree in mathematics. I have earnestly admired his constant aspiration for acquiring knowledge, his desire to excel in his professional sphere. I am deeply convinced that Petar Kormushev will make a brilliant career. In a few brief years only he has managed to organize Software department with more than 15 developers. The software products developed under his management are still working and profitable. I consider this to be a unique deed. As a person Petar is unostentatious, honest, loyal, well-mannered, steady and ambitious. He sets himself realistic tasks and attains his end following a fixed schedule. He is permanently educating himself and is very good at organizing people around an idea. However, he is sometimes too shy. Petar has the gift for understanding the people he is in contact with. He is always considerate and thoughtful in his attitude and never loses his

temper. He is exacting but just towards his subordinates and makes serious efforts to support them in their professional development.” April 22, 2009

--- [Jacko Pillossof](#), *Technical Director of Kontrax and Owner of Power Partner, managed Petar directly*

“I have known Petar Kormushev since 2001/2002 academic year in his capacity of one of my students at Sofia University, Bulgaria. I could rank him among the top one percent students I have taught for more than 20 years. Petar has a very good experience both in individual and collective project activities. In this sense I could emphasize on his excellent results (in successive collaboration with other students) in some course projects within the framework of the AI M.Sc. program as well as his brilliant AI M.Sc. thesis in the field of Semantic Web Services. Petar was the winner of the “St. Kliment Ohridski” Foundation student award for outstanding achievements in 2005.” April 24, 2009

--- [Maria Nisheva](#), *Assoc. Professor, Sofia University, supervised Petar in MSc. Artificial Intelligence*

“Petar Kormushev was one of my best students - diligent and active in the classroom. He finished the exam in Discrete Mathematics (that I'm teaching) with excellent grade. He was also a member of one of the best programming teams that I'm training in Sofia University - many times he and his teammates represented Sofia University in national and international programming contests.” April 29, 2009

--- [Krassimir Manev](#), *Assoc. Professor, Sofia University, taught Petar during his BSc. Computer science*

THE END

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