# CURRICULUM VITAE

*(Last updated: September 10, 2015)*

## PERSONAL DATA

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|---|---|
| *Name:* | **Petar Kormushev** |
| *Nationality:* | Bulgaria (EU member) |
| *Born in:* | 1980 |
| *Civil status:* | married |
| *Personal website:* | [http://kormushev.com] |
| *E-mail:* | petar@kormushev.com |
| *LinkedIn profile:* | [www.linkedin.com/in/petarkormushev] |

*Research interests:* Robotics, machine learning, computational intelligence

## CURRENT POSITIONS

*Position:* Lecturer, Dyson School of Design Engineering
*Employer:* **Imperial College London**, UK

*Position:* Visiting Senior Research Fellow
*Employer:* Department of Informatics, **King's College London** (KCL), UK

## WORK EXPERIENCE

| | | |
|---|---|---|
| 2011 ~ 2015 (**4 years**) | Italian Institute of Technology, Team Leader | www.iit.it |
| 2012 ~ 2012 (**1 week**) | University of Girona (Spain) Invited Lecturer | www.udg.edu |
| 2011 ~ 2011 (**1 month**) | Tokyo City University (Japan) Visiting Researcher | www.tcu.ac.jp |
| 2009 ~ 2011 (**2 years**) | Italian Institute of Technology, Senior Post Doc | www.iit.it |
| 2008 ~ 2008 (**3 months**) | Google, Software Engineering intern (Google Japan) | www.google.com |
| 2000 ~ 2006 (**6 years**) | Kontrax, Software Project Manager | www.kontrax.bg |
| 1999 ~ 2000 (**1 year**) | Power Partner, Software Engineer | www.ppartner.com |

## 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 |

## AWARDS

2013 — "John Atanasoff" award from the President
Awarded by the President of Bulgaria for scientific excellence and contributions to the development of Information and Communications Technologies (ICT) in Bulgaria and abroad. The award bears the name of Prof John Atanasoff (who is of Bulgarian descent) – the inventor of the first electronic digital computer.

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

2005 — "St. Kliment Ohridski" award
Awarded by the President of Sofia University, for exceptional academic achievements and extracurricular activities

2002 "John Atanasoff" scholarship
Awarded by Eureka Foundation for outstanding achievements in Computer Science [www.evrika.org]. The award was devoted to the 100th birthday of Prof John Atanasoff.

## LANGUAGES

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

## RESEARCH PROJECTS

2012 ~ 2015 (**4 years**) **FP7 (IP) project STIFF-FLOP**

This is a collaborative project executed by 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 project started in January 2012.

2012 ~ 2014 (**3 years**) **FP7 (STREP) project PANDORA**

This is a collaborative project executed by 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 project started in 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.

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

My up-to-date publication list is available online at: http://kormushev.com/research/publications/

My Google Scholar profile: http://scholar.google.com/citations?user=z6CxsHsAAAAJ

## RESEARCH TOPICS

### 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]
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.

### 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.
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. 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 WSML 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.

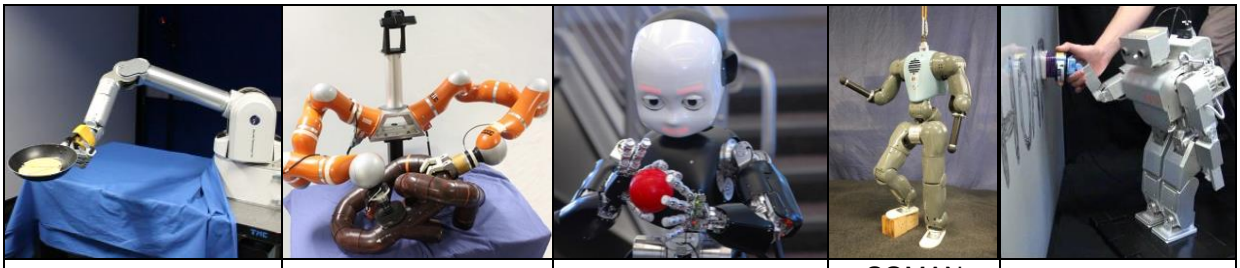
### Bio-Medical Informatics and Data Mining

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.

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

## Experience with Robot Equipment

These are some of the robots I have used for conducting my research experiments. The extensive expertise I have gained in controlling, programming and calibrating these robots is knowledge that I will transfer to the host.



| Barrett WAM arm | KUKA dual-arm | iCub humanoid | COMAN humanoid | HOAP-2 humanoid |
|---|---|---|---|---|

Videos of my experiments are available online: http://kormushev.com/research/videos/

## 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 |
| Web | PHP, JSP, ASP, JavaScript |
| Markup | HTML, DHTML, CSS, XML, XSL/XSLT |

### Programming Platforms

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|---|---|
| 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 |

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|---|---|
| Version Control | Perforce, GIT, SVN, MS Visual SourceSafe, Borland StarTeam, Team Source |
| Modeling | ERWin, Poseidon (ArgoUML), MS Visio |
| Bug-tracking | Mantis |

### Software Technologies

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|---|---|
| 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 | .NET, 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, 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.

## Academic Activities (selected)

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|---|---|
| Invited talk | Invited Talk at Google DeepMind, London (UK), 2013 |
| Invited lecturer | University of Girona (Spain), 2012 |
| Visiting researcher | Tokyo City University (Japan), 2011 |
| Invited talk | Imperial College London (UK), 2012 |
| Invited talk | National Inst. of Adv. Industrial Science and Tech. – AIST (Japan), 2009 |

## Company Experience

### Software Engineer

Software engineering division of Google Japan [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] - (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] - (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

Cisco Certified Network Associate, 2005

BrainBench Certified Professional, 2002 ~ 2006

JAXA Space Science Program Certificate, AWS-2006

Member of MENSA International, 2005

## PROGRAMMING COMPETITIONS

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|---|---|
| 2004 | IBM Research, "Ponder This" problem solving competition |
| 2001 | 3rd place in the Bulgarian National Programming Competition |
| 2000 | 5th place in the Bulgarian National Programming Competition |
| 1999~2003 | Regular participant in the FMI programming competitions, |
| 1997~1999 | Regular participant in "Eureka" problem solving contest |
| 1995~1999 | Regular participant in the National Olympiad in Computer Science |

## THE END