# Annotated Table of Contents

## Welcome to AI Matters
Kiri Wagstaff, Editor
Full article: [http://doi.acm.org/10.1145/2639475.2639476](http://doi.acm.org/10.1145/2639475.2639476)

A welcome from the Editor of AI Matters and an encouragement to submit for the next issue.

### Artificial Intelligence: No Longer Just for You and Me
Yolanda Gil, SIGAI Chair
Full article: [http://doi.acm.org/10.1145/2639475.2639477](http://doi.acm.org/10.1145/2639475.2639477)

The Chair of SIGAI waxes enthusiastic about the current state of and future prospects for AI developments and innovations. She also reports on high school student projects featured at the 2014 Intel Science and Engineering Fair.

### Announcing the SIGAI Career Network and Conference
Sanmay Das, Susan L. Epstein, and Yolanda Gil
Full article: [http://doi.acm.org/10.1145/2639475.2649581](http://doi.acm.org/10.1145/2639475.2649581)

SIGAI has created a career networking website and annual conference for the benefit of early career scientists. Benefits include mentoring, networking, and job connections.

### Future Progress in Artificial Intelligence: A Poll Among Experts
Vincent C. Müller and Nick Bostrom
Full article: [http://doi.acm.org/10.1145/2639475.2639478](http://doi.acm.org/10.1145/2639475.2639478)

When will intelligent systems surpass human intelligence? This study surveyed experts and found that they predict that this time, sometimes referred to as the singularity, will occur before 2080. The study also found that nearly one third of experts surveyed have strong concerns about the negative impact on humanity.

### Drop-in Challenge games at RoboCup.
Peter Stone, Patrick MacAlpine, Katie Genter, and Sam Barrett. Full image and details: [http://doi.acm.org/10.1145/2639475.2655756](http://doi.acm.org/10.1145/2639475.2655756)

### Using Agent-Based Modeling and Cultural Algorithms to Predict the Location of Submerged Ancient Occupational Sites
Robert G. Reynolds, Areej Salaymeh, John O'Shea, and Ashley Lemke
Full article: [http://doi.acm.org/10.1145/2639475.2639479](http://doi.acm.org/10.1145/2639475.2639479)

A collaboration between archaeologists and artificial intelligence experts has discovered ancient hunting sites submerged in over 120 feet of water in Lake Huron. This is the oldest known hunting ground in the world.

### A New Approach for Disruption Management in Airline Operations Control
Antonio J. M. Castro, Ana Paula Rocha, and Eugénio Oliveira
Full article: [http://doi.acm.org/10.1145/2639475.2639480](http://doi.acm.org/10.1145/2639475.2639480)

This new book describes the application of a multi-agent approach to address challenges in airline operations. It provides rapid responses to disruptive events so as to minimize the impacts on the crew and passengers.
The NY AI Summit: A Meeting of AI Discipline Leaders
Organized by IJCAI and AAAI
Francesca Rossi (IJCAI President) and Manuela Veloso (AAAI President)
Full article: http://doi.acm.org/10.1145/2639475.2639481
AAAI and IJCAI co-organized a meeting to discuss the future of AI, including conference coordination, how AI sub-disciplines relate, and societal impact. This report features highlights of the event and describes next steps to better coordinate sub-disciplines and create an open information structure to disseminate and coordinate community-wide information.

Submit your Ph.D. briefing here!
See the AI Matters website for more info.

Upcoming Conferences
Registration discount for SIGAI members.

**WI-IAT '14**: Web Intelligence and Intelligent Agent Technology. Warsaw, Poland, Aug. 11-14, 2014.


(Submission: Sept. 22, 2014)

(Submission: Oct. 3, 2014)

**IUI '15**: International Conf. on Intelligent User Interfaces. Atlanta, GA. Mar. 29 - Apr. 1, 2015.
(Submission: Oct. 17, 2014)

Links
SIGAI website: http://sigai.acm.org/
Newsletter: http://sigai.acm.org/aimatters/
Twitter: http://twitter.com/acm_sigai/

Edition DOI: 10.1145/2639475
Abstract: In some quarters, there is intense concern about high–level machine intelligence and superintelligent AI coming up in a few decades, bringing with it significant risks for humanity; in other quarters, these issues are ignored or considered science fiction. We wanted to clarify what the distribution of opinions actually is, what probability the best experts currently assign to high–level machine intelligence coming up within a particular time–frame, which risks they see with that development and how fast they see these developing. We thus designed a brief questionnaire and distributed it to four groups of experts. Overall, the results show an agreement among experts that AI systems will probably reach overall human ability around 2040–2050 and move on to superintelligence in less than 30 years thereafter. The experts say the probability is about one in three that this development turns out to be ‘bad’ or ‘extremely bad’ for humanity.

1. Problem
The idea of the generally intelligent agent continues to play an important unifying role for the discipline(s) of artificial intelligence, it also leads fairly naturally to the possibility of a superintelligence. If we humans could create artificial general intelligent ability at a roughly human level, then this creation could, in turn, create yet higher intelligence, which could, in turn, create yet higher intelligence, and so on ... “We can tentatively define a superintelligence as any intellect that greatly exceeds the cognitive performance of humans in virtually all domains of interest.” (Bostrom, 2014 ch. 2).

For the questionnaire we settled for a definition that a) is based on behavioral ability, b) avoids the notion of a general ‘human–level’ and c) uses a newly coined term. We put this definition in the preamble of the questionnaire: “Define a ‘high–level machine intelligence’ (HLMI) as one that can carry out most human professions at least as well as a typical human.”

2. Questionnaire
The questionnaire was carried out online by invitation to particular individuals from four different groups. The groups we asked were:
- AGI: Participants of the conferences of “Artificial General Intelligence” (AGI 12) and “Impacts and Risks of Artificial General Intelligence” (AGI Impacts 2012), both Oxford December 2012, organized by both of us (see Müller, 2014). Response rate 65%, 72 out of 111.
- EETN: Members of the Greek Association for Artificial Intelligence (EETN). Response rate 10%, 26 out of 250 (asked via e-mail list).
- TOP100: The 100 ‘Top authors in artificial intelligence’ by ‘citation’ in ‘all years’ according to Microsoft Academic Search in May 2013. Response rate 29%, 29 out of 100.

Total response rate: 31%; 170 out of 549. We also review prior work in (Michie, 1973, p. 511f), (Moor, 2006), (Baum, Goertzel, & Goertzel, 2011); and (Sandberg & Bostrom, 2011).

3. Answers
1) “In your opinion, what are the research approaches that might contribute the most to the development of such HLMI?: ...” There were
no significant differences between groups here, except that ‘Whole brain emulation’ got 0% in TOP100, but 46% in AGI.

2) “For the purposes of this question, assume that human scientific activity continues without major negative disruption. By what year would you see a (10%/50%/90%) probability for such HLMI to exist?”

Predicted years, sorted by HLMI probability:

<table>
<thead>
<tr>
<th></th>
<th>10% Median</th>
<th>Mean</th>
<th>St. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PT-AI</td>
<td>2023</td>
<td>2043</td>
<td>81</td>
</tr>
<tr>
<td>AGI</td>
<td>2022</td>
<td>2033</td>
<td>60</td>
</tr>
<tr>
<td>EETN</td>
<td>2020</td>
<td>2033</td>
<td>29</td>
</tr>
<tr>
<td>TOP100</td>
<td>2024</td>
<td>2034</td>
<td>33</td>
</tr>
<tr>
<td>ALL</td>
<td>2022</td>
<td>2036</td>
<td>59</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>50% Median</th>
<th>Mean</th>
<th>St. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PT-AI</td>
<td>2048</td>
<td>2092</td>
<td>166</td>
</tr>
<tr>
<td>AGI</td>
<td>2040</td>
<td>2073</td>
<td>144</td>
</tr>
<tr>
<td>EETN</td>
<td>2050</td>
<td>2097</td>
<td>200</td>
</tr>
<tr>
<td>TOP100</td>
<td>2050</td>
<td>2072</td>
<td>110</td>
</tr>
<tr>
<td>ALL</td>
<td>2040</td>
<td>2081</td>
<td>153</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>90% Median</th>
<th>Mean</th>
<th>St. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PT-AI</td>
<td>2080</td>
<td>2247</td>
<td>515</td>
</tr>
<tr>
<td>AGI</td>
<td>2065</td>
<td>2130</td>
<td>202</td>
</tr>
<tr>
<td>EETN</td>
<td>2093</td>
<td>2292</td>
<td>675</td>
</tr>
<tr>
<td>TOP100</td>
<td>2070</td>
<td>2168</td>
<td>342</td>
</tr>
<tr>
<td>ALL</td>
<td>2075</td>
<td>2183</td>
<td>396</td>
</tr>
</tbody>
</table>

The median is 2050 or 2048 for three groups and 2040 for AGI – a relatively small group that is defined by a belief in early HLMI. We would suggest that a fair representation of the result in non-technical terms is: Experts expect that between 2040 and 2050 high-level machine intelligence will be more likely than not.

3) For the transition from HLMI to superintelligence, responses were:

<table>
<thead>
<tr>
<th></th>
<th>Median</th>
<th>Mean</th>
<th>St. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within 2 years</td>
<td>10%</td>
<td>19%</td>
<td>24</td>
</tr>
<tr>
<td>Within 30 years</td>
<td>75%</td>
<td>62%</td>
<td>35</td>
</tr>
</tbody>
</table>

Experts allocate a low probability for a fast take-off, but a significant probability for superintelligence within 30 years after HLMI.

4) For the overall impact of superintelligence on humanity, the assessment was:

<table>
<thead>
<tr>
<th></th>
<th>PT-AI</th>
<th>AGI</th>
<th>EETN</th>
<th>TOP100</th>
<th>ALL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely good</td>
<td>17</td>
<td>28</td>
<td>31</td>
<td>20</td>
<td>24</td>
</tr>
<tr>
<td>On balance good</td>
<td>24</td>
<td>25</td>
<td>30</td>
<td>40</td>
<td>28</td>
</tr>
<tr>
<td>More or less neutral</td>
<td>23</td>
<td>12</td>
<td>20</td>
<td>19</td>
<td>17</td>
</tr>
<tr>
<td>On balance bad</td>
<td>17</td>
<td>12</td>
<td>13</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Extremely bad (existential catastrophe)</td>
<td>18</td>
<td>24</td>
<td>6</td>
<td>8</td>
<td>18</td>
</tr>
</tbody>
</table>

We complement this paper with a small site on http://www.pt-ai.org/ai-polls/. On this site, we provide a) the raw data from our results, b) the basic results of the questionnaire, c) the comments made, and d) the questionnaire in an online format where anyone can fill it in.

References


Vincent C. Müller's research focuses on the nature and future of computational systems, particularly on the prospects of artificial intelligence. He is the coordinator of the European Network for Cognitive Systems, Robotics and Interaction (2009-2014) with over 900 members (3.9 mil. €, www.eucognition.org). He has organized a number of prominent conferences in the field. Müller has published a number of articles and edited volumes on the philosophy of computing, the philosophy of AI and cognitive science, the philosophy of language, and related areas. He works at Anatolia College/ACT and at the University of Oxford.

Nick Bostrom is a professor of the Philosophy & Oxford Martin School, Director of the Future of Humanity Institute, and Director of the Programme on the Impacts of Future Technology at the University of Oxford.