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Cognitive Assistance in Government and Public Sector Applications

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Abstract: The Cognitive Assistance in Government and Public Sector symposium was held in Arlington, Virginia, USA, from November 12-14, 2015 as part of the Association for the Advancement of Artificial Intelligence (AAAI) Fall Symposium Series. The goal of this symposium was to present the state of cognitive assistance projects and to identify the opportunities and challenges of creating Cognitive Assistance (Cog) systems with an emphasis on the challenges and opportunities presented by Government and public sector applications. We hoped the outcome from the symposium could be used to scope a research agenda based on gaps in current capabilities.

The concept of a Cognitive Assistant as a partner to help humans perform their work better dates to the early days of AI, including the writings of Engelbart [1] and Licklider [2]. For the purposes of this symposium, we defined cognitive assistance by combining excerpts from two important documents:

Cognitive assistance is “a systematic approach to increasing human intellectual effectiveness” that assumes “computational assists to human decision making are best when the human is thought of as a partner in solving problems and executing decision processes, where the strengths and benefits of machine and humans are treated as complementary co-systems.”

The first quotation is from *Augmenting Human Intellect: A Conceptual Framework*, by Douglas C. Engelbart, October 1962 [1]. The second is from *Complex Operational Decision Making in Networked Systems of Humans and Machines* by the Committee on Integrating Humans, Machines and Networks; National Research Council, 2014.[3]

Recent advances in AI and cognitive computing, such as IBM’s Watson, Digital Reasoning’s Synthesys, deep learning, and natural language processing, along with the vast increase in the world’s data stores, are enabling renewed hope that there are now growing opportunities to offer knowledge workers a partner in their efforts. Cognitive assistance in government presents opportunities and challenges – some in common with other domains, and some distinct, which we intended to explore in this symposium.

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4 The symposium brought together researchers from industry, government, and academia. The
5 topics discussed covered cognitive assistance for law, intelligence analysts, cyber-security,
6 contracting officers, healthcare professionals, and office workers. The types of support
7 considered ranged from enhancing creativity to supporting cognitively challenged individuals
8 and those with dementia.
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12 One major theme of papers presented at the symposium was the variety and complexity of
13 government and public sector use cases. Because of the complex laws, regulations, processes,
14 and procedures required by government agencies, cognitive assistants operating in this
15 environment must operate in compliance with these constraints. These compliance
16 requirements will vary by agency and use case. Presenters also discussed the wide variety of
17 users that cognitive assistance might need to support – from citizens and new employees who
18 are naïve users, to subject matter experts, to those with dementia. The scale of the cognitive
19 systems presented also varied from those supporting an individual such as a patient, to those
20 supporting the public or a large call center (such as those operated by large government
21 organizations) which will have to operate at scale.
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26 The symposium also included two invited talks by Jerome Pesenti and Tim Estes. The talk
27 given by Jerome Pesenti (IBM Watson) focused on the developments of Watson since the
28 Jeopardy Challenge in order to support the company’s customers. Statistical models can now
29 be leveraged to achieve high levels of performance on various specific tasks (Watson, speech
30 understanding, image recognition, etc.). A collection of models can be used to discover
31 relationships among multiple data types across tasks. IBM is pushing in this direction by
32 developing a collection of cognitive services and apps that can be used as building blocks for
33 cognitive assistants, along with advice about the appropriate patterns of use for those services
34 and apps.
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40 Tim Estes (Digital Reasoning) described the developments at his company around knowledge
41 representations, knowledge graphs, and their recent advances in deep learning. There has been
42 a progression in applications from data triage and enrichment to question answering to
43 autonomous delegation. The biggest obstacle to progress is knowledge representation, though
44 deep nets, graphical models, and transfer learning will help. However, it is important to avoid
45 overstating what an intelligent system can currently do. Assistants do not necessarily have to
46 have a natural language interaction with users, but learning is a fundamental requirement for
47 almost all of this software.
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53 The symposium also included a panel discussion on workforce issues associated with use of
54 cognitive assistants. Participants discussed how cognitive assistance systems impact some
55 professions (e.g., eliminating the time consuming discovery work of 1st year lawyers) but will
56 create economic development in other areas (e.g., personalized medicine).
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4 A major conclusion reached during the symposium, which we agreed was a critical acceptance
5 factor for government and public sector applications, is the importance of trust. Many
6 cognitive assistant uses will be in “mission-critical” applications where health, finances, national
7 security, or lives will be at stake. Presenters discussed the need for cognitive assistance
8 systems to adequately assess and present to the user the confidence the system has in the
9 output. There was discussion around trusting too little vs. trusting too much, and how to be
10 transparent in explaining the basis for decisions or recommendations. It was acknowledged
11 that the needs for transparency and explanation in cognitive assistance systems are likely to be
12 be open research challenges and areas for design focus for a while to come.
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17 The symposium was useful in showcasing many different examples of cognitive assistant
18 projects and bringing together those involved to share experiences. The participants share a
19 common goal of developing cognitive assistance systems, and agreed that they would like to
20 attend future symposia with the same focus as this one.
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