Dr. BIPLAV SRIVASTAVA
Research Staff Member, IBM Master Inventor, IBM T.J. Watson Research Center
ACM Distinguished Scientist, ACM Distinguished Speaker

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Elevator Pitch

Biplav is an experienced researcher and technologist interested in enabling people to make rational decisions despite real world complexities of poor data, changing goals and limited resources by augmenting their cognitive limitations with technology. His expertise is in Artificial Intelligence, Sustainability and Services, with proven track record of many science firsts and high-impact innovation ($B+) in global business environment. Biplav has received major recognitions for technical work, patents and prototypes from external community and IBM, interacted with commercial customers as well as universities and governments, represented company at standard bodies (W3C, Partnership on AI), and assisted business leaders at highest levels with technical issues.

Ever seeking to break new grounds, Biplav's has been recently working on promoting goal-oriented, ethical, human-machine collaboration using learning and reasoning. He applied them with sensor and open data in domains like water, traffic, space and health. Two were shown at AAAI 2018 and one won the best demo award.

Fields of Interest / Proficiency

AI (Analytics) – Learning, Reasoning, Representation, Ethics, Constraints, Scheduling
- Machine Learning – deep learning, adversarial attacks, bias, classification, clustering, recommendation; ML Tools: Tensorflow/ Tensorboard, Keras, scikit-learn, Weka
- Reasoning – planning, scheduling, parameter tuning, preferences, satisfiability
- Representation – ontology modeling, evolution, extraction from text, semantic web services

Data - Semantic Web, Open and Big Data, Provenance, Data Mining, Information Extraction, Sensors;
Business Integration – Web Computing Models, Asset Reuse, Service Delivery Optimization, Business Processes;
- Cloud Computing – APIs/REST, Web Services, Devops
- Languages: Python, Java, C++/C, Common Lisp, Prolog

Industries – Water, Sustainable Transportation, Public Health, Governance, Telecommunications, Retail

Education (all degrees in Computer Science)

- Ph.D.: Arizona State University, Tempe, AZ, USA — Fall 1996- Spring 2000
  Dissertation Topic: Efficient Planning by Effective Resource Reasoning
- M.S.: Arizona State University, Tempe, AZ, USA GPA:4.0/4.0 — Fall 1994 - Summer 1996
- B.Tech.: Indian Institute of Technology (IIT), B.H.U., India GPA:9.06/10 — Fall 1989- Summer 1993
- Micro-MBA: Management module at IBM taught by top-US MBA faculties — Fall 2016, 2011 (1 week), Summer 2005 (6 months)

Experience Summary

Research Experience: 23.5 years (Industry – IBM Research: 17.5; Academic – ASU: 6)
Interleaved Development Experience: 5.5 years fulltime (Philips - 4, Bodha – 0.5, TCS: 1)

2016-	Research Staff Member, MI	IBM T.J. Watson Lab, NY, USA
2009-2016	Senior Researcher, MI	IBM Research, New Delhi, India
2007-2009	Research Staff Member	IBM T.J. Watson Lab, NY, USA
2001-2007	Research Staff Member	IBM Research, New Delhi and Bangalore, India
2000-2001	Core Technology Architect, R&D	Bodha.com, Los Altos, CA, USA
1996-2000	Senior Staff Engineer PhD Scholar	Philips Semi. (VLSI Tech.), Phoenix, USA Arizona State University, USA
1994-1996	MS Student	Arizona State University, USA
1993-1994	Assistant System Analyst	TCS, New Delhi, India

Papers

- 130+ refereed research papers in leading international journals, conferences and other forums; **published at all top forums in major fields of interest (i.e., AI, Services and Sustainability)**
- Over 3000 citations. Full listing at Google scholar web site and on request.

Patents/ Intellectual Property

1. 44 US patents have been granted; single inventor on 4
2. IBM's 17th Plateau Award for Technical achievements
3. Lead and worked with technical and legal teams to build patent portfolios for over a decade.

Select Recent Apps and Tools (Co-Created or Lead)

Science	"A Cognitive Assistant for Visualizing and Analyzing Exoplanets". Paper at AAAI 2018. ****Awarded AAAI 2018 Best Demonstration Award ****.** Video - http://ibm.biz/tyson-demo (Feb 2018).
Water	• "Water Advisor, a chat based advisor to taking decisions related to water taking into account water pollution". Paper at AAAI 2018, see video available at Youtube - https://www.youtube.com/watch?v=z4x44sxC3zA (Sep 2017). • WaterWatch app for water pollution information on Google playstore. App - https://play.google.com/store/apps/details?id=com.research.waterwatch&hl=en. Code - https://github.com/sandeep-iitr/Water-Watch • GangaWatch app for water pollution information on Google playstore. Video - https://youtu.be/MbVvVGsZoTo. See description on LinkedIn blog (Jan 2016). • Neer Bandhu (Water Friend) app on Google playstore. See description here on LinkedIn blog. (Nov 2015)
Tourism	• Bharat Khoj (Discover India) app on Google playstore, Demo paper at IJCAI 2016 and high-level description here in the blog.(Jan 2016). Bharat Khoj, a suite of novel, standards based, online applications for promoting and hosting tourist events spanning collection of high-level events with semi-automatic attendance estimation, event dissemination and an automatic experience indicator for a visitor. See video and the web app; (Sep 2014). • CityConcierge app (video) is intended to serve as a one-stop destination to know more about the cities one cares about. It came **runner-up** in the CitySDK App Challenge, an EU funded competitive initiative and won a Euro 2000 prize. (June 2014)
City	CityExplorer - http://city-explorer.mybluemix.net/, for comparing Indian cities based on open data from http://data.gov.in (April 2015). Paper at COMAD

Major Awards/Honors

2018	• **Association for Advancement of Artificial Intelligence (AAAI) 2018 Best Demonstration Award** for demo "A Cognitive Assistant for Visualizing and Analyzing Exoplanets", New Orleans, USA, Feb 2018. Video -http://ibm.biz/tyson-demo • **Representing IBM** at Partnership on AI's Working Group on Fair, Transparent and Accountable AI (2018-). https://www.partnershiponai.org
2017	• **IBM's Outstanding Technical Achievement Award (OTAA),** an individual award for leading Co-leading Adaptive Web Services scientific accomplishment to Outstanding level. • **IBM's Research Division Award** for Research contribution to cognitive recruiting dashboard.
2016	• **ACM Distinguished Speaker, second term (2016-2019),** first (2013-2016) (http://dsp.acm.org/view_lecturer.cfm?lecturer_id=4923. Offering 7 topics for public lectures. [Individual recognition] • **IBM's Outstanding Science Accomplishment Award** for Adaptive Web Service Composition technology for significant long-term impact with 4000+ citations, best papers; lead a major component called Synthy which has 1100+ citations, 20+ related PhDs, 7 patents; industry pilots. [Group recognition]
2015	• External Industry Member of Government of India's Open Government Data Taskforce setup for implementing National Data Sharing and Accessibility Policy. Details at http://data.gov.in • **IBM's Research Division Award** for Watson for Technical Support Services technology
2014 and before (select)	• **ACM Distinguished Scientist,** for significant scientific achievements and impact, http://www.acm.org/press-room/news-releases/2014/distinguished-2014 • Lead a team that came **runner-up** in the CitySDK App Challenge(http://dev.hel.fi/node/199), a EU funded competitive initiative and won a 2000 Euro prize. CityConcierge app is detailed at http://www.slideshare.net/biplavsrivastava/city-concierge-presentation10june2014). • **IBM's Outstanding Technical Achievement Award (OTAA),** an individual award for leading Synthy web services scientific accomplishment. [2014] • IBM's Accomplishment Award for Cognitive solutions for improving technical support services; given when an innovation has lead to at least $10m impact [2014] • **IBM's Corporate Award**, the highest internal individual awards for "leadership

	contributions to SAP NextGen Tools and its Impact on SAP Clients"; given for multi-billion $ impact and new industry practice. [Group recognition; 2012] • **Represented IBM** at World Wide Web Consortium (W3C's) working group on Government Linked Data (GLD): www.w3.org/2011/gld/ (2011 - 2013) • 2011-2014: **IBM Master Inventor** – for outstanding patent activities • Government of India's prestigious **National Talent Search Examination Scholarship** (NTSE) for excellence in science (1987 - 1993)

Customers, Government Interaction, People Management

1. Experience in interacting with commercial customers around the world, be Fortune-500 conglomerates or leaders in particular industries like airlines, transportation, construction and IT technology. [2000-]
2. International experience in interacting with non-profits for science-based initiatives in water management (USA, India). [2015-]
3. International experience in interacting with city governments around the world including Boston (USA), Singapore, Delhi and Bangalore (India), Ho Chi Minh City (Vietnam). [2010-]
4. Rich collaboration with leading Computer Science academics in USA, Canada, Vietnam, Australia, Italy and India, as well as with industrial research labs (PARC, MSR) and government labs (India). [1996-]
5. Technical lead on major research projects for over 16 years involving group size varying from 2 to 7 members. Teams have been local as well as globally distributed. [1998-]
6. Mentor or academic advisor to many graduate students (cum professionals) within IBM and students at premier institutions in India (IITs, IISc) and abroad (specifically USA, France). [2005-]

Professional Services

- Prolific in organizing conferences (10+) and workshop events (30+), Program Committee participation in top AI conferences (50+); presented 5 tutorials at top international conferences, speaker at universities and blogger on technical topics; Details: https://sites.google.com/site/biplavsrivastava/talksntools, ACM DSP talks are here: http://dsp.acm.org/view_lecturer.cfm?lecturer_id=4923
- Running the "AI in India" Google group since 2010 with 250+ members presently. Details: http://groups.google.com/group/ai-in-india
- Member of ACM, AAAI

Summary of Research Track Record and Its Practical Significance

In Artificial Intelligence (AI), Biplav has worked in the areas of learning (machine and deep learning), reasoning (planning and scheduling), and knowledge representation for open and sensor data.

In learning, Biplav has worked on detecting and handling of adversarial attacks on AI services from training data, rating AI services for bias (AIES 2018), recommendation strategies for information elicitation (IUI 2018) and products (EC-Web 2002), and automatic tuning of parameters for planners (AAAI 2005). He recently lead a work on characterizing and predicting delays of trains in India using zero-shot learning.
In reasoning, Biplav's work on diverse planning was the first in the field on how to measure plans based on distance and automatically generate a set of plans with quality constraints (e.g., dis-similarity) in the presence of incomplete or unknown preferences. He formulated the problem based on experience of applying planning in automated system management (i.e., web services composition and autonomic computing), engaged some of the best minds in AI, and it lead to work published in AIJ 2012, IJCAI 2009, IJCAI 2007 and a PhD thesis. The work has wide applications to the original motivations, as well as areas like traffic management and security.

In representation, Biplav has worked on building complex ontologies like SCRIBE for city events, and used them to drive semantic matching (ISWC 2005, WWW2005) and compositional service discovery.
Since 2016, Biplav has been exploring the role of reasoning (planning) and learning for human-agent dialogs in individual and group settings. Use cases are (a) explaining large datasets and their insights to people, and (b) embodiment agents (environment or room) that can track the discussion and intervene to provide decision support to a group of people.
[Impact]

. Recent work on reasoning and learning for chatbots in CHIA dialog platform has been delivered to Watson product group (2018). Two were shown in AAAI 2018 and one won the best demo award.
. Application of planning techniques in Services has lead to many science (~2000 citations) and industry firsts (O-level Research accomplishment); see under Services.

In Sustainablilty, Biplav has worked on decision-support methods and tools for water, traffic, tourism and open data. Full details are at: https://sites.google.com/site/biplavsrivastava/research-1/intelligent-systems

Since 2015, Biplav has lead the BlueWater initiative to make water pollution data and their insights accessible and usable to stakeholders. Recently, he presented a chat based tool, Water Advisor, to help people make decisions related to water-use, like Flint, taking into account water pollution" at AAAI 2018; video at Youtube - https://www.youtube.com/watch?v=z4x44sxC3zA. Other works include making water quality insights available on mobile apps (Water Watch), multi-sensor data collection and managing water-centered tourist events with millions of people. He gave a tutorial on them at AAAI 2017 (Tutorial-AAAI 2017).

In traffic, Biplav has worked on formulating the underpinnings of traffic problem (ITS 2011) and carpooling (ITS 2012), and novel sensing techniques that can address complexities confronting developing world (ITS 2013b, ITSC 2011, IIWeb 2011). He **pioneered** building of useful journey recommendation tools without deep sensors by using available static public transportation data and cross-purposing existing dynamic data in new ways (ITSC 2012, IBMRI 2014). He has worked with government agencies in USA (Boston – ITS 2013) and Asia (Vietnam, India, Singapore) on these problems and given two tutorials at major AI conferences (Tutorial-IJCAI 2013, Tutorial-AAAI 2012). Another major work theme is SCRIBE semantic models that streamlines inter-agency collaboration in cities while adhering to emerging open standards (NIEM, CAP) in government and IT middleware space (https://github.com/rschloss/ismp, WIMS 2013, IJCAIWS 2011). Finally, he has looked to accelerate public decision-making in the presence of uncertainty (UAI 2013, AAAIWS14).
[Impact]

. Work on journey recommenders for cities in emerging countries prompted cities to act initiate pilot studies. Lead to multiple client engagements, 5 papers and 4 patents.
. Part of a Government of India taskforce on open data since 2015.
. Worked as Technical assistant to a Vice-President focusing on Smarter Cities for1 year [2010-2011]
. Represented IBM at World Wide Web Consortium (W3C's) working group on Government Linked Data (GLD): www.w3.org/2011/gld/

In Services, Biplav has explored AI planning ideas in the emerging area of automated system management (i.e., web services composition, autonomic computing) and which have created both scientific and business impact.

He lead the **first** end-to-end automated web service composition approach, called **Synthy,** that composes SOA-compliant components (Web Services) to create a new composite web service while meeting the desired functional and non-functional requirements (JoWS 2005, WWW 2005, AAAI 2006, ISWC 2005, Compute 2008, ICAPSWS 2003). Synthy is as much significant for tackling various aspects of web service composition as for applying different facets of computer science – AI Planning, Web Semantics, Distributed Computing and Optimization. Details: https://sites.google.com/site/biplavsrivastava/research-1/synthy-web-services. Another **first** in web services is Semaplan, an approach which Biplav co-invented to represent and match services using semantics and planning techniques (ICWS 2006) that was implemented and made available as a major feature in IBM's software offering. In autonomic computing, Biplav articulated the role of declarative methods like planning in automated control, incorporated a Java-based family of planners in agent toolkit (ABLE) and demonstrated their real-world usage with selective automation (ICAPS 2005, ICAC 2004).

In business processes, Biplav co- invented methods to increase the efficiency of business consultants working on packaged application projects (e.g., SAP and Oracle). Specifically, the new techniques were on how to harvest business process documents captured in prior projects, create models and then develop model-based cloud-enabled tools to reuse and organize content. He created additional technologies to learn models from enterprise documents, use APQC's Process Classification Framework to align vendor's offerings and compare business processes & their hierarchies. This not only pushed BPM (business process management) science (SCC 2009, SCC2010a, SCC2010b, SAC2010) but also lead to multi-billion dollar business impact in IBM's consulting practices. He also conceived an approach to model assets containing software and related artifacts using ontologies that can promote large-scale software component reuse using a repository enabling higher precision and recall, and also to extract such an ontology from software design artifacts [SWBook 2008, SCC 2008, SCC 2007].
[Impact]

. The packaged application technologies have been adopted in mainstream business services after piloting with customers and **lead to multi-billion USD impact**. **Biplav was recognized with *IBM's highest award - Corporate award*,** and work lead to 5 papers, 14 patents/applications.
. As technical lead on Synthy web services approach, saw the built tool piloted with a large Indian telecommunication customer and lead to a rich IP pool. Work lead to 14 papers, 6 patents, ~1100 citations and influenced over 20 PhD over the last 10 years. **The work was awarded IBM Research's O-level science accomplishment for test-of-time impact in 2017.**