Profile: Lior Horesh

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EARLY INFLUENCES

What sparked your interest in mathematics? When did you know that you would use math as a path to your career?

My interest in math started already in my childhood. I found beauty in the consistency and logic that math brought to seemingly disordered or disjointed aspects. Math to me was a universal mean to elegantly express and enable prediction of the world around us. Later on, I grew to appreciate numerical methods and their great applicability in describing natural phenomena. Nevertheless, probably only during my post-doc, the realization that math is indeed my driver (rather than any other domain specific perspective) came to bear.

If some other field of study led you to mathematics, please tell us about it.

In my early research career, I was enchanted by the quest to better understand how the brain works. I found the complexity of the neuronal interaction exciting and in order to deepen my understanding, I took advanced medicine and biology courses alongside physics courses. Through my PhD research work in a neuroscience lab, I gradually came to recognize that in order to be able to model real-life phenomena and more interestingly resolve what is seemingly non-resolvable (inverse problems), numerical analysis and optimization skills are essential. From there, my scope broadened further into other applied math disciplines, which repeatedly proved themselves as a generic skill set applicable to a broad range of problems.

Was there a pivotal moment/experience/ influential person that led you in this direction? Any memorable courses or experiences that made a difference in directing you to your career? Any obstacles you needed to overcome?

As an obstacle, coming from a medical physics background and converting to applied math, there was a lot of material to catch up on. In addition, as much of the early scholar credentials were rendered irrelevant from applied math perspective, there was a need to re-establish oneself in the applied math community.

CAREER/CAREER PATH

Describe your current position and briefly, the path you took to get there.

Currently, I am a Research Staff Member in IBM TJ Watson Research Center. My research work involves a combination of applied and fundamental research aspects, where the focus revolves around large-scale simulation and inversion.

What is a typical day at work for you? Please list your job responsibilities. What are you responsible for?

A typical working day often begins with coordination discussions with peers in labs around the world, continues with a few hours of algorithmic development interlaced with client/internal meetings and attendance in seminar talks (having close to 2,000 scientists in one building, there are seminar talks on a broad range of topics daily). Occasionally, one may be engaged in business development activities, such as presentation in client workshops, or preparation of joint industry research proposals.

What do you like best and least about your profession? What is the stress level associated with this type of position?

One the greatest appeals of applied math is its transferability to a broad range of domain fields. Applied math principles can literally be utilized in almost every aspect of life, enabling one to explore a great diversity of turfs.

Since we enjoy a great deal of autonomy, stress levels can vary, and mainly depend upon one's own ambition and drive. Since we work with external clients, we are required to deliver useful, and appreciable (in the eye of the client!) deliverables; this implies that we do need to deal with deadlines and review meetings.

How many hours per day or week do you typically work? Do you have flexibility that allows a good life/work balance?

At IBM Research, we have full flexibility in terms of schedule and working remotely. We have a great degree of autonomy, as long as we deliver our required dues. The corporation is international, and that often implies discussions across multiple time zones. Flexibility can be a double edge sword, as it transfers the responsibility of setting the boundaries between professional life and personal life to your own hands. Those that are talented in time management can surely benefit from such settings, those who are not, may need to battle occasionally to keep their personal time.

CAREER EXPECTATIONS FOR YOUR FIELD/POSITION

How/why are applied mathematics and/or computational science important to your industry? How are they used?

Many real-life problems involve partial, noisy, and indirect data, realistic models (complex and of large scale), requiring state-of-the-art optimization schemes to provide insights and feed decision making, and of course, also, provide means for quantification

of uncertainty. Implementation of solutions to such challenges that extend beyond toy problem level requires deep knowledge in applied math (numerical analysis, optimization), statistics, computational math as well as integration of specific domain knowledge.

It is also important to understand that many of today's challenges can no longer be tackled by a single researcher. Back in the 70's quantification of an individual's intelligence was popular, yet, recently the focus has changed towards the notion of collective intelligence. In industrial research settings, collaborative work and team play are of great importance. Recently, IBM is putting efforts into extension of the scope even further, towards cooperative interaction with cognitive computing systems.

Where do you see the future of math in industry or in your particular career?
As the world becomes ever more instrumented with sensor data, and higher desired levels of description, prediction and decision-making under uncertainty capabilities are required, more sophisticated and complex solution frameworks are essential. First, as it becomes more evident, while dealing with complex systems, Big Data mindset is no longer adequate to capture the full complexity of the underlying problems, and shift towards formulation of Big Models of superior predictive power. Furthermore, often in practice, we fall into the practice of "garbage in garbage out," forgetting that the true essence is not in Big Data, but rather in being prescriptive (i.e. experimental design) to get the Right Data. Lastly, I foresee a transition towards development of solutions that are end-goal oriented, integrating seamlessly simulation, optimization, control, decisions, and design.

ADVICE

If you could advise someone currently pursuing the same degree or profession, what would you say? What are some steps you would recommend to students, or to those in their early careers, that perhaps you wish you had taken earlier? Are there things you would have done differently?
First, to stand out from the crowd, acquisition of multi-disciplinary education can provide a unique perspective while tackling new challenges. There is obviously a price in doing so, as qualification may be longer, and only part of one's accomplishments will be appreciated by a given professional society, yet, on the longer run, it can equip one with tools to understand better real-life problems. Second, it is instrumental to develop a "hands on" attitude, especially in being able to prototype in code proposed algorithms. Third, it is critical for one's career development to form an extensive professional network that can advise, direct, and provide career opportunities when needed. Lastly, one should be encouraged to keep an open-minded approach to learn and tackle problems that may seem to be outside one's comfort zone.

Any specific supplementary skills or training you can name that a person pursuing this profession should acquire?
On top of the conventional applied and computational math skills, interpersonal and presentation skills may play a greater role in industrial research. For proper teamwork coordination, it is valuable to learn how to integrate with other's activities, listen to their opinions and provide convincing arguments when needed. As part of the activity involves client interaction, good presentation skills make the difference between a fruitful collaboration and one that is not.

SALARY

For 2015, can you speculate about the salary range of starting, mid-level and /or senior positions in your specific field?
The ranges vary dramatically even internally in a single corporate. There are web resources, such as glassdoor, that can provide one with a good estimates (including spread) for levels of compensation per roles, experience.