CAREERS

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MIRKO ZIMIC

Mirko Zimic (left), a physicist at Cayetano Heredia University in Lima was funded by Google to develop a low-cost telediagnostics system for tuberculosis.

COLLABORATION

Plug into industry

Researchers are forging mutually beneficial partnerships with technology giants.

BY GABRIEL POPKIN

Hannah Bast's research into improving computer algorithms has racked up thousands of citations. But its impact skyrocketed when she went to work temporarily at Google's research facility in Zurich, Switzerland.

While there, Bast, a computer scientist at the University of Freiburg in Germany, collaborated with company engineers to improve public-transport route planning; she then secured a large grant to build on the effort back at Freiburg. Algorithms that she helped to develop now underlie the popular Google Maps app and are used daily by millions.

Bast is one of thousands of academics who have looked to the technology industry for research funding and collaboration opportunities in recent years. "It was one of the best things I ever did," she says.

"Having a look from the industry side gives a lot of challenges and also a new way of thinking about problems," adds Moustafa Youssef, a computer scientist who studies mobile computing at the Egypt–Japan University of Science and Technology in Alexandria.

Google, for example, has poured more than US$250 million into academia since 2005, and Samsung is pumping $1.5 billion into Korean research institutions through a funding programme launched in 2013. Software, Internet and mobile-communications industries are also introducing new opportunities in a wide range of emerging fields.

Working with tech companies, and taking their money, can enable scientists to design research relevant to practical applications, and can open up pathways to industry careers. Companies benefit by tapping into the creativity of outside scientists. "Any round [of funding] we do, maybe 10 or 12 of the proposals are things we would never have thought of," says Maggie Johnson, vice-president of education and university programmes for Google. And visiting scholars can explore potential uses of company data or technology that employees don't have time to pursue.

There are limitations. Research projects must generally be related to a company's business interests. Prior professional connections to company employees, perhaps as a result of conference networking, can play a substantial part in determining who gets funding. And ▶

scientists who take temporary positions at companies might have to sign non-disclosure agreements and take care to avoid compromising proprietary data — concerns not typically encountered with conventional research grants and public data sets.

But despite these potential downsides, industry cash can help early-career researchers to get projects off the ground and generate data to support larger research proposals.

"The industry funding does help a lot in the early days," says Ranjitha Kumar, a computer scientist at the University of Illinois at Urbana–Champaign, who has used early-career grants from Adobe, Amazon and Google to launch a research programme on how people interact with e-commerce websites.

N. INIYAN THIRUSELVAM

Sankara Subramanian measures a turbine blade at his start-up.

FREE MONEY

Long-established firms such as IBM, Intel and Samsung have funded academic research for decades. In the past two decades, Google, Microsoft, Amazon, Facebook and Adobe, as well as the Chinese technology conglomerate Tencent, phonemaker Huawei and e-commerce platform Alibaba, have entered the game as well. Most run competitive grant programmes with an open call for proposals on their websites. And at many of these firms, the number of proposals funded annually is increasing.

Google alone supports more than 250 external research projects per year, says Johnson, on topics ranging from data privacy and security to machine learning and translation, to virtual reality and quantum computing. Typical tech-company grants range from $25,000 to $100,000 a year. The money usually goes to support a graduate student or postdoctoral researcher to work on a specific project. Funded researchers are free to publish in the open literature, and in most cases retain intellectual-property rights over any discoveries.

"From our perspective, it's free money," says Florian Metze, a computer scientist at Carnegie Mellon University in Pittsburgh, Pennsylvania, who has received funding from Google, Facebook and Amazon to develop algorithms that generate automated text descriptions of the content of online videos.

Although tech grants are generally smaller than government grants, they are often simpler to apply for, with streamlined applications running to just a few pages. "It kind of works out to the same monetary amount per page" of application, says Kumar, who studies how consumers interact with online fashion-shopping platforms. Moreover, companies typically prohibit universities from skimming off 'indirect costs', so all money goes to the researcher.

For some scientists, the draw is less about the money than about getting a company's attention. Mirko Zimic, a biologist at Cayetano Heredia University in Lima, received about $25,000 from Google to study whether mobile phones and artificial intelligence can help to quickly and cheaply diagnose drug-resistant tuberculosis (TB) — the money was enough to support a graduate student and pay for some cheap microscopes. The real pay-off, he hopes, will come later. "If we can show Google that we have an operative algorithm for correctly classifying TB, we could have a Google-powered telediagnostics system," he says.

Companies can offer more than just cash. Many put award recipients in touch with staff researchers who can provide advice or collaborate on projects, sometimes leading to joint publications. Many also host conferences where funded researchers present results, and where important connections can be made. Amazon offers funded researchers up to $20,000 in Amazon Web Services credits, which can be redeemed to run computationally intensive programs on the firm's computers, or to harness specific technologies such as facial-recognition software.

REWARD AND RISK

Industry grants have some disadvantages compared with conventional funding streams, however. Most last only one year — short-term even for funding a PhD student or postdoc — and there's no guarantee of renewal. "I can't plan ahead three to four years with industry grants," Metze says. "It can't be the backbone of your lab structure." He has mitigated the uncertainty by cobbling together funding from multiple companies and government agencies — which got easier once he had won his first few industry grants, he adds.

Research areas that tech companies fund are skewed heavily towards fields related to their business. Artificial intelligence, human–computer interfaces, wireless power transmission, Internet security, computational neuroscience and quantum computing, among other research areas, are all well represented. But researchers in less obvious fields might still find openings, because companies are constantly seeking new business and product opportunities. For example, Microsoft funds research on the analysis of environmental data using cloud computing and machine-learning algorithms, through its AI for Earth programme. And Amazon has funded projects on topics as far-reaching as creating a telephone directory for Tanzania.

Although more companies are putting out open calls for applications, having an established connection with someone at a company can help a lot. (Microsoft's programme makes this a requirement: applicants for faculty fellowships must be sponsored either by a staff researcher or by an attendee of a past Microsoft conference.) Programme managers encourage potential applicants to attend meetings where they can network with current grantees and company researchers and discover shared interests.

Contributing to a real-world product can be exciting, Metze says, but funded researchers don't always get a chance to share in the profits — or even the development — of a product or service based on their research. "They are typically very careful to not talk about upcoming products."

Also, companies typically do not provide access to any internal or proprietary data. "They're giving you money to answer research questions, but it's still up to you to figure out how you're going to get access to data to answer the questions," Kumar says. She has built her own applications, and recruited users to gather data.

Partly for that reason, however, researchers don't fear damage to their reputation from being associated with technology companies, despite the spate of negative publicity that has recently harmed the industry's public image. "I haven't seen any backlash from taking money from certain companies," says Kumar.

THE INSIDE WORD

Representatives of technology companies say they look to academics to pursue speculative, early-stage research whose pay-offs are too uncertain to justify having full-time staff devoted to it. In return, researchers get a glimpse into where major industrial players think new technologies could emerge in the next few years.

"We bring know-how on where the industry is going," says Gabriela Cruz Thompson, director of university research and collaboration for Intel Labs in Portland, Oregon, "and what we think could become a commercialized opportunity in three to five years." She cites a "neuromorphic chip that doesn't exist in the commercial world" but that Intel-funded researchers can use to develop artificial intelligence in ways that mimic the workings of the human brain.

Most firms have an open application period

once a year. Interested scientists apply online, typically filling out a short application describing their proposed project and potential applications, their research background and qualifications, and how they plan to spend the money. Some programmes include extra steps; for example, Microsoft invites finalists to the company's headquarters for one-to-one interviews.

Competition for such awards is increasing. Amazon fielded more than 800 funding applications in its most recent round, of which 49 were funded, says Ralf Herbrich, director of machine learning at Amazon and managing director of the Amazon Development Center Germany in Berlin. Funded researchers so far have come from the United States, Canada and Europe, but the most recent round drew a more geographically diverse set of applicants, Herbrich says. Johnson is seeing a similar trend at Google; she received 17% more applications in the company's latest funding round, including an 87% bump in applications from universities in the Asia Pacific region.

Scientists can set themselves apart by proposing original, rather than incremental, ideas. "We're looking for people who are real innovators," says John Krumm, a principal researcher at Microsoft Research in Redmond, Washington, which gives out five research awards each year. "If you're adding 0.5% accuracy to a problem that's been studied for decades, that doesn't stand out quite as much as if you've formulated a new problem and one of the first solutions for it."

Herbrich agrees. "Is this a big swing or not?" he asks, when considering proposals. "Will it affect many people? Is it technically interesting?"

Some companies also make larger investments in university research. Intel, for example, donates between $1 million and $3 million to about 15 'centres' at select universities, where researchers collaborate on a problem. A centre at Delft University of Technology in the Netherlands, for instance, is developing quantum-computing technology. Microsoft also funds quantum-computing research at several universities. Samsung owns an entire university, Sungkyunkwan University in Seoul, where researchers can take advantage of company funding and data streams while also competing for outside funds. In 2013, the company launched a $1.5-billion programme that hands out five-year awards of about $450,000 a year — comparable to many government grants — to Korean academics. Around 75 such grants were given out in 2018, according to the company's website.

SABBATICALS

Those who want closer ties to the tech industry can use a university sabbatical to work inside a company. Google, for example, offers a visiting faculty programme at its headquarters in Mountain View, California; researchers can also work at one of its satellite campuses. Other tech giants offer similar opportunities.

"It's one thing to read a couple of papers here and there. But it's an entirely different feeling to be surrounded by this expertise, and attend seminars, talk to people and reach out and introduce yourself," says Sankara Subramanian, who until last August was in the engineering and design department at the Indian Institute of Technology Madras in Chennai. He spent a year at Google's headquarters, where he used the company's sophisticated robotics tools to try to make robots better at picking up non-rigid objects. Subramanian used the knowledge he gained to launch a research project at his home institution on the mechanics of robotic grasping; he now works full-time on a start-up company that he's dubbed PhotoGAUGE. He says that Google's research environment helped to spawn the idea for the fledgling business.

LAB CONNECTIONS

Students can also benefit from working in the labs of principal investigators with connections to technology companies, says Youssef, who worked at Google from May to December 2016; his project there was related to obtaining better accuracy for Google Location services. He has also received funding and in-kind donations from Google, Intel, Microsoft and several other tech firms, and his students have got summer internships at companies. Youssef is preparing a paper for publication. Although the work could have raised concerns about Google's user data, the data that he could access were stripped of personal information, he says.

"Typically, data are not available in any kind of raw format for most Googlers to look at," says Jason Freidenfelds, a Google communications manager, regarding the company's internal-data policy. "You have to have very specific access, and have to have specific reasons."

Scientists' publication rates might fall while they are temporarily working at companies, partly because publishing is less of a focus than it is in academia, and partly because companies are concerned about protecting intellectual property. On the flip side, working within a company provides a chance to contribute to real-world products, says Bast, who got a 'Focused Research Award' of $1 million from Google, after her 1.5-year visiting-scholar stint, to continue improving transport-planning algorithms. "It's great for companies to get someone from the outside to just think deeply about some problems," she says. "It's a real win–win situation. I can recommend it to anyone." ■

Gabriel Popkin *is a freelance writer in Mount Rainier, Maryland.*

WORKING RELATIONSHIPS

How mentors affect careers

Postdocs reap biggest gain.

BY CHRIS WOOLSTON

Researchers who incorporate ideas and techniques from multiple mentors while still forging their own paths are the most likely to succeed in academia, according to a study of 18,865 biomedical researchers, published last year (J. F. Liénard *et al. Nature Commun.* **9**, 4840; 2018). The authors also suggest that mentoring received during postdoctoral training had a bigger impact than mentoring received during graduate school.

The study analysed data from the Academic Family Tree, an online database of academic relationships that launched in January 2005. The authors identified 'triplets' — trios comprised a scientist, their graduate mentor and their postdoctoral mentor — dating back to 1970.

Professional success was gauged in part by the number of trainees a researcher mentored per decade, and an analysis of terms used in abstracts made it possible to track similarity of scientific approaches. The results give empirical evidence to support popular career strategies, says study co-author Stephen David, a neuroscientist at the Oregon Health & Science University in Portland. For example, the most successful scientists transferred concepts they learnt in graduate school to their postdoctoral work, suggesting that prospective postdocs should try to join labs that lack their particular skills.

"You want to be able to offer something new," David says. That requires stepping beyond the shadow of a graduate mentor without becoming a facsimile of a postdoctoral mentor. "You have to stake out some unique territory, which is always a challenge for postdocs," he says.

The study found that joining the lab of a prolific mentor — one who has trained many researchers over the years — also increases a scientist's chance of success. This held true for both graduate and postdoctoral mentors, but a closer look at the data revealed that the qualities of a postdoctoral mentor were especially predictive of success. "You can get a graduate education just about anywhere," David says. "Postdoc labs are where you establish professional relationships and develop collaborations."

Researchers should be especially discerning when accepting postdoctoral positions, David says. "You can take a data-driven approach to choosing your mentor." ■

CORRECTION

The Careers Feature 'Plug into industry' (*Nature* **565**, 665–667; 2019) misdescribed physicist Mirko Zimic as a biologist. Also, Sankara Subramanian is in the engineering and design department, not the engineering department, at the Indian Institute of Technology Madras.