U.S. Senate Committee on the Judiciary
Subcommittee on Intellectual Property
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Artificial Intelligence and Intellectual Property – Part I: Patents, Innovation, and Competition

Written Testimony of
Ms. Laura Sheridan
Head of Patent Policy
Google

Chairman Coons, Ranking Member Tillis and Members of the Committee:

Thank you for the opportunity to appear before you today. My name is Laura Sheridan, and I am the head of patent policy at Google. I look forward to answering the Committee's questions on artificial intelligence and patenting.

Google's approach to artificial intelligence (AI) is both bold and responsible. We believe we must develop AI in a way that maximizes the positive benefits to society while addressing the challenges. As we innovate, we are guided by our AI Principles, first introduced in 2018. The only way to be truly bold in the long-term is to be responsible from the start.

Google is utilizing AI in our groundbreaking products used by people everywhere, in our contributions to scientific advances that benefit people, and in helping to address societal challenges. The potential of AI to solve big problems is rapidly increasing and we are proud of efforts to partner in the use of this technology to help address problems and improve the lives of people around the world.

AI has played an important role as a powerful tool for enabling more rapid innovation than was previously possible. Among other things, we are deploying AI to help forecast floods, monitor prenatal health, and detect genetic variations linked to disease. We are also using AI to help expedite chip floorplanning, identify optimal neural network architectures, and improve upon the drug design process, which are described in greater detail below.

Google's patent portfolio counts more than 62,000 patents worldwide, with more than 27,000 patents in the U.S. alone. As part of this portfolio, we pursue patent protection for many AI innovations. According to a report by the U.S. Patent and Trademark Office (USPTO) on AI patenting activity, Google has one of the largest patent portfolios in AI technology.

I. GOOGLE'S DEVELOPMENT OF ARTIFICIAL INTELLIGENCE TECHNOLOGY

AI provides tremendous potential across numerous fields, including scientific exploration such as prediction modeling. For example, in 2018, Google began our flood forecasting initiative to help combat the catastrophic damage from floods each year by equipping those in harm's way with accurate and detailed reports. With the power of AI, we expanded our reach to send out over 115 million potentially life-saving alerts. Our flood alerts display inundation maps, which show the extent and depth of flooding on top of Google Maps, so people can visualize this critical information more easily. And we developed a new manifold inundation model relying on AI that enables us to scale these efforts significantly.

AI technology has already created scientific advances yielding real-world benefits. One significant achievement includes advances in understanding protein folding. Proteins are complex molecules essential to life. Each has its own unique 3D shape that determines how it works and what it does. Knowing how proteins fold has the potential to help scientists make enormous progress in every field of biology. Google created AlphaFold, an AI-powered system which accurately predicts the shape of proteins, and released the AlphaFold Protein Structure Database containing more than 200 million protein structures, covering nearly all cataloged proteins known to science.

Google also uses AI technology to power WaveNet, which creates more natural-sounding speech for products used by millions of people around the world. WaveNet emerged from our team's research in generative models, a type of AI system that is trained on speech samples. It creates the waveforms of speech patterns by predicting which sounds likely follow each other. By including intonation, accents, emotions, and other vital layers of communication overlooked by earlier systems, WaveNet delivers a richness and depth to computer-generated voices.

II. RECENT ENGAGEMENTS WITH THE U.S. PATENT AND TRADEMARK OFFICE

A. Listening Session on Artificial Intelligence Inventorship

Google participated in the USPTO AI Listening Session on May 8, 2023. At the event, the USPTO shared that there is a spectrum of inventive behavior, with an invention resulting from a human inventor without the use of an AI tool at one end, and a purely AI-generated invention at the other end. The inventorship question is clear at both ends of the spectrum (yes for the human, no for the AI), but it becomes less clear as you have a human inventing with AI assisting in the process. In our view, current industry uses of AI are well within the zone where humans are properly named as the inventors and where AI is leveraged as a tool in the invention process. We expect to remain in this zone for some time.

Google appreciates USPTO's exploration of the end of the spectrum where AI has a more prominent role that could impact the inventorship calculus. As we shared at the Listening Session, we have time to consider this in depth and ensure we are avoiding unintended consequences with any proposed adjustments, as this is an area where "fixing" one thing may break another. In the meantime, the current law supports inventorship for technology created with the assistance of AI.

B. Comment on Artificial Intelligence and Inventorship

Google submitted a comment to the USPTO regarding AI and inventorship on May 15, 2023. In this comment, we explained that although Google is confident that inventorship for innovations brought about by using AI tools is properly held by the technologists – just as it always has been for inventions brought about through the usage of tools – we encouraged the USPTO to shed light on inventorship. Inventorship can be a challenging area for patent applicants as it is highly fact dependent and often complicated. We explained that guidance from the Office would allow for a clearer conversation between patent applicants and their counsel. This is the case whether or not AI is involved in the innovation process. This could include guidance on the usage of tools, giving patent applicants a better understanding of the role tools play in the inventing process.

We also respectfully suggested that the USPTO should encourage patent applicants to formally document inventor contributions. Having inventor contribution information memorialized would be beneficial in the patent prosecution record itself, providing transparency into the inventorship calculus and demonstrating the good faith effort made by the patent applicant to get it right. This can also be beneficial to any downstream litigation. And it is consistent with similar activity in the research community, where the contributions of individual authors on technical papers are getting more clearly identified.

To support this and other conversations about AI-related activity, we have also encouraged the USPTO to adopt standardized definitions for the different categories of AI-related inventions so that it is always clear what is, and is not, being discussed. This will provide a helpful framework as these issues grow in complexity and importance. We explained that we believe the definitions jointly proposed by the Intellectual Property Owners Association and the American Intellectual Property Law Association are a good solution. They speak to three categories of inventions: inventions on core AI technology, inventions on specific applications of core AI technology, and inventions generated by or using AI.

Finally, in its continued engagement with stakeholders at the intersection of AI and intellectual property, we have encouraged the USPTO to implement robust technical training for any patent examiner who is examining AI-related innovations, whether those are inventions on core AI technology or inventions on specific applications of core AI technology. As the USPTO's recent AI report demonstrates, the number of patent examiners who are now examining these AI-related inventions makes up a substantial portion of the examining corps, and that number is only going to increase. We urged that a comprehensive technical training program be put in place so that patent examiners are well-situated to assess whether or not to grant a patent. In addition to these generalized comments, we also provided responses to specific questions asked in the Request for Comment.

C. Testimony for Fee Hearing

While not specific to AI, Google also provided testimony in conjunction with the USPTO's recent hearing on its proposed fee structure. As we emphasized in our remarks, we believe that the USPTO will be in the best position to grant robust and reliable patent rights when the fees before grant of a patent more closely match the costs, instead of relying upon the maintenance of a patent for that recovery. This allows for more resources to be available for the challenging tasks associated with patent examination, including prior art searching, understanding what the patent claim terms mean, applying the prior art to the claims, and ensuring the statutory requirements are met. This must be accomplished in a way that does not hinder the ability of our small and micro entities to pursue patent protection for their innovations. Large companies can and should support the overall health of the patent system.

For complex technologies like AI, which 50 percent of the patents granted in 2020 related to in some way, having adequate resources up front is critical to ensuring that deserving patents are granted, while those that do not satisfy the statutory requirements are not. We thanked the USPTO for moving in this direction, and encouraged it to work toward full cost recovery.

III. AI IS A TOOL, NOT AN INVENTOR

As with other technical tools, AI has contributed to the inventive process for decades. What is different today is how AI has improved in terms of its capabilities, making it possible to carry our research much faster than ever before. As a result, AI is increasingly being leveraged by technology companies, the pharmaceutical industry, manufacturing businesses, and others. Along with AI systems, there are numerous other computational tools used in the invention process, including computational chemistry, integrated circuit design algorithms, and other computer simulations. AI and non-AI tools can similarly enable the invention process, depending on how they are leveraged by the technologist.

We have seen that when using AI as a tool for innovation, humans are involved in a way that makes them inventors for the resulting innovations. This involvement includes designing the AI system to achieve a specific purpose, analyzing the output of the AI system and appreciating it as inventive, or forming an invention based on the output. The invention being claimed in a patent application will reflect the involvement of the technologist, and their usage of the AI as a tool to enable the invention process.

Google has extensive experience leveraging AI in the innovation process across our wide range of products, services, and R&D efforts. We support AI-assisted innovation across a wide swath of industries through our cloud services like Vertex AI and our open source software like TensorFlow. Some notable examples include using it to help expedite chip floorplanning, identify optimal neural network architectures, and improve upon the drug design process. In each of these examples, AI has played an important role as a powerful tool for enabling more rapid innovation than was previously possible.

- **Chip Floorplanning:** Chip floorplanning is a step in the chip design process where engineers attempt to optimally place components on a chip. An optimal design may account for parameters like wire length, power, and timing. Chip floorplanning is frequently done with the help of computer algorithms and simulation, using as inputs a "netlist" and a canvas that provides the chip dimension and pin locations. The result of this is a floorplan, with the components placed on the chip canvas in some optimal arrangement. Google has invented novel machine learning models for chip floorplanning, and has used these models as tools in the chip design process.

  In using these models to develop chip floorplans, our technologists are involved in designing the underlying model to generate optimized floorplans, analyzing and modifying the outputted chip floorplan, and deriving concepts for optimal arrangements based on observation of several floorplans generated by the model. Patents on inventions appreciated and derived from the generated floorplan outputs could be pursued with the technologists as the proper inventors, and the AI system as the tool that helped enable the process.

- **Optimal Neural Network Architecture Search:** Neural architecture search (NAS) is a machine learning approach for identifying optimal neural architectures for training a model for a given task (e.g., image recognition). NAS is intended to replace or supplement the time-intensive manual neural architecture design process. Depending on the NAS approach, the identified neural architectures may be existing neural architectures, or may be entirely new. Google has invented an automated NAS approach called MnasNet, which is used to identify neural architectures appropriate for training models used on mobile devices.

We have used MnasNet to enable the identification of an improved model architecture for image recognition running on mobile devices. We then trained the identified neural architecture and experienced a significant improvement on what was the state of the art for mobile image recognition. The identified architecture included both 3x3 and 5x5 convolutions, which is different from previous mobile device models that only used 3x3 convolutions. Patents on the architecture for mobile image recognition that was appreciated and derived from the generated output could be pursued with the technologists as the proper inventors, and MnasNet as the tool that helped enable the process.

- **Drug Design:** An early step in drug discovery is often attempting to find small molecules that will bind to a given protein. This process is called hit-finding and was historically very expensive to scale. One current approach to make hit-finding more scalable is to use DNA-encoded small molecule libraries (DELs). A DEL is composed of many compounds, each of which is tagged with a DNA sequence to identify it. To screen a DEL against a target, the DEL is mixed with the target and the compounds in the DEL that do not bind are washed away. The remaining compound/target mixture is then DNA sequenced to identify the subset of binding compounds in the DEL.

  Google and its partners recently applied machine learning to make DELs more effective in hit-finding by predicting additional hits outside a given DEL. The data from a DEL screening was used to train an AI model to predict which compounds would be hits. The resulting model was then applied to a large library of additional compounds to predict additional hits. The resulting predicted hits were then filtered automatically and manually to account for diversity, stability, and reactivity. The filtered predicted hits were validated experimentally in a lab. Patents on the validated compounds, if novel and nonobvious, could be pursued with the technologists as the proper inventors, and the AI system as the tool that helped enable the process.

IV. CLOSING

Thank you for the opportunity to appear before you today. We appreciate this important discussion on the current state of AI and patenting. Google continues to engage with government officials and the public to further discussions on AI and responsible development principles. We will continue to provide education and resources for our researchers, engage with governments and external organizations to develop standards and best practices, and work with communities and experts to make AI safer and more useful. Google will also continue to provide our feedback on the intersection of AI and patents in order to ensure that we continue to strike the right balance for our patent system to incentivize AI innovation.