ARTIFICIAL INTELLIGENCE AND THE FUTURE OF INVENTION DISCLOSURES



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THE EVOLUTION FROM ELIMINATION TO AGGREGATION TO AUTOMATION

Artificial Intelligence (AI), when implemented correctly, uses humans' biggest weakness to its advantage: the management and analysis of huge quantities of data. Confronted with several million documents all containing different information, a legal practitioner's first goal will be to reduce that to a reasonable level. That is often what previous workflow technology has been previously used for, particularly in the legal realm. Document management systems filter by date, author and keywords, RSS feeds show only news stories pertaining to an attorney's current cases and even the "find" function on PDFs documents help you ignore most of the target document. The performance of these tools does not improve when the amount of data it is tasked with handling increases, in fact in most cases it declines.

For example, consider the task of searching for all divorce cases with a keyword in Massachusetts, compared with the entire country. A simple filtration seartch

for the former task will return a significantly more manageable result set than the task that operates on a larger corpus, i.e. filtration techniques gradually lose their effectiveness as the target corpus increases in size

Closely following filtration techniques was technology focusing on the *aggtregation* of data, which often foAfter filtration and aggregation, the next step in legal technology will take full advantage of this quantity of available legal data using artificial intelligence.

cuses on higher level data analysis. Sticking with the case of divorce, users are shown how the number of divorce cases have increased over time, specified by the jurisdiction and any number of other variables. The presented data can help the user make a more informed decision about a case or matter. But these tools



remain focused on the visualization of data, given a set of well-specified and pre-defined question. The user of this software must be an expert in the field to extract any value from it. Additionally, these tools cannot take advantage of the vast quantity of data that it processes.

After filtration and aggregation, the next step in legal technology will take full advantage of this quantity of available legal data using artificial intelligence. A crucial aspect of this new technology is that users will require increasingly less domain specific knowledge, more directly connecting the legal system to those who are directly affected by it. This will consequently free legal professionals to focus more on strategy, rather than spending valuable time on repetitive tasks such as information acquisition.

Yet this artificial intelligence cannot be realized without appreciating legal documents as a useful asset, rather than noise to be merely sifted through or organized. Key to realizing this potential is understanding the structure that underlies legal documents, in this case, patents. By extracting aspects of patents that are useful cases, much rote expertise can be replaced by artificially intelligent software that interacts with the inventor.

THE NEED FOR AI IN THE IP DEPARTMENT

Invention disclosure is a perfect first application of this artificial intelligence. A crucial first step in the patent process, the invention disclosure is how a potentially patentable idea is first documented and brought to the attention of a company's legal department. While legal data analytics tools are somewhat improving the process for how invention disclosures are tracked and managed, they do nothing to improve the quality of the disclosures themselves, or encourage inventors to initially make the disclosure. For many companies, the process around invention disclosure is ad hoc; an inventor might document an invention if they think it may be patentable or in some cases if they are told to by a superior. This documentation is often done on their own volition and with little structure as to what the disclosure should look like.

The current process thus leaves much clear room for improvement. The authors' experience in almost 1000 companies suggest that the invention disclosure

E PORTFOLIO	ELECTRIC BATTERY DRIVETRAIN Autonomous Cars - Parts	TITLE OF INVENTION DATE FILED MATCH ANALYSIS Self-druing car befoulding
O SETTINGS	Filed Brian Duffin	Method and system steering 2015-10-28 03% match
	(i) (i) (ii)	Autonomous refueling 2017-01-11 63% match
	IDF8527 Sense for electric Electric motor, system Beachic pressure. Mountain View, CA Mountain, View, CA	Apparatus and method for prediction of time 2015-02-27 24% match autonomous driving
		IBM Autonomously servicing self- 2015-11-12 20% match
	COMPANY HISTORY	
	Roter design for an electric motor US20150089476 A1 Sept. 27 2017	PATENT TRENDS Autonomous Cars
	 Integrated factory pressure relief and terminal (solation system) US20100316094 A1 2009-06-12 	$\wedge \wedge \wedge /$
	(39) Electric vehicle battery lifetime optimization operational mode USS00762988 2012-02-88	

forms all look alike and are trivial. Yet the language used to form the questions create an enormous barrier for first time inventors. Some companies have a Patent 101 course, but these tend to be about a patent format and the need for patents, nothing about assisting a new or even experienced inventor to be motivated to document and improve their quality of submission. As a result, many potentially patentable ideas are never adequately documented or identified at all.

A handful of companies have tried to improve this process through systematic programs aimed at extracting and documenting potential inventions. In the late 1980s, IBM began systematizing their invention disclosure process through the IBM Patent Factory. The Patent Factory used systematic processes for interviewing inventors in a structured way, extracting key aspects of the invention. These disclosure forms were much more robust, asking strategic questions about how to improve the invention. "Patent Facilitators" would document robust invention disclosures using all this data as well as understanding the business case, eliminating the burden of new and even experienced inventors from the headaches of documenting. By systematizing the invention disclosure process, IBM captured thousands more inventions per year that may have otherwise been missed. Additionally, internal studies showed that when documented this way, the quality of the disclosures increased significantly.

Even with systematic process in place, the current approach to handling invention disclosures still has many limitations and problems. For large companies, the volume of data related to invention disclosures is very high. If company is filing 100 patents per year, they may be reviewing many times 100 disclosures. This demands a lot of human capital to manage, review, rate and post-process efficiently. Additionally, the relationship between the inventor and legal department is unidirectional. The inventor writes a disclosure and it's submitted to the legal departments, but there is very limited back and forth between the two parties to improve quality of the disclosure. Once submitted, the legal department does a patent search and may decide at that point to not move forward with the disclosure. There is no feedback between the patent search results, the patent attorney's opinion and the inventor that would help improve the content of future disclosures from that inventor.

HOW AI CAN IMPROVE THE INVENTION DISCLOSURE PROCESS

Al has the potential to make leaps in efficiency by simultaneously decreasing the necessary level of human resources while increasing the iterative aspect of invention. If an inventor can disclose their invention in an interactive and natural interface, it lowers the psychological barrier of invention and

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makes it an enjoyable process that inventors want to engage in. At the same time, this also augments the time of the legal departments, resulting in improved efficiency. Much of what legal staff does in the invention disclosure process is very repetitive. Al can replace and improve virtually every aspect of this process from informing the inventor about the patent process, to asking basic interview questions, to even guiding inventors towards a more strategic version of their invention.



	Static invention disclosure	Attorney Interview	AI IDF
Collection of logistical information	•	•	•
Confidential	•	•	•
Engaging process for inventor		•	•
Questions specific to technology domain		•	•
Each invention disclosure is costless	•		•
IP department tracks inventor patent search			•
Inventor can update anytime			٠
IP staff tracks inventor behavior			۰
Prior art displayed is controlled by IP department			•
Creation of "inventor network" within company			•
Automatic classification of technology domains			۲
Real-time prior art search			•

FIGURE 1: Comparisons of Invention Disclosure modes!

An AI assisted invention disclosure software would replace both the invention disclosure form process, as well as the initial several interviews between the inventor and the attorney. The AI software is encapsulating the two primary advantages that an attorney interview has over a static invention disclosure form: inventor engagement and domain specific questioning. Interactive and modern user interface design keeps the inventor engaged in the process, while detection of patent classifications using artificial intelligence directs the system to follow a line of inquiry specific to the technology.

Unlike either pre-existing solution (static form or attorney interview), the IP department has complete transparency into and control over the inventor experience. The types of prior art seen by the inventor can be filtered by assignee, classification, etc., directing them towards the most strategic manifestation of their technology. IP professionals within the company can clearly see the thought process of the inventor from start to finish, rather than depending on a single agent or attorney's notes (or memory). Furthermore, connections between inventors working on complementary technology can be made instantaneously, greatly increasing innovation potential within an organization. And not to be discounted, each additional use of the AI product is essentially costless, compared with thousands of dollars of attorney fees.



AI-BASED THEMATIC INQUIRY OF THE INVENTION DISCLOSURE

When an inventor is challenged to document their technology as an invention disclosure, many crucial questions must be answered such as, what problem they are solving, how they solved their problem and what novel about their solution. While these questions may seem relatively simple, any professional tasked with extracting straightforward and coherent answers from inventors will tell you otherwise. Before such a professional has had hundreds of interviews under his/her belt, the process quickly becomes time-consuming and frustrating.

For an example, imagine an inventor has been working on improving a traffic light. When asked how they've made it "better", they will begin to iterate all the features that have been improved. The inventor will say that it's lighter and brighter, uses less power, easier to see at a distance, more weather-proof, and easier to test the quality before shipping. Management thus decides to ask the inventor to file a patent on the improved traffic light before offering for sale. When then asked what problem has been solved, they are usually dumbfounded as they have solved dozens, thus the answer doesn't yield results. If the inventor is asked what is really "novel" about the traffic light, they are again dumbfounded. All the components were off-the-shelf, and they really don't know much about the "prior art". How do you begin to figure out what is patentable?

In comes the experienced professional, who over time comes to find out that the inventor had reviewed the many traffic lights in the market and found complaints that heavy winds were blowing traffic lights off their connectors. As s/ he discusses what was worked on, the inventor mentions that "I made it aerodynamic"! The learned professional leans in and asks if there were trade-offs in making the traffic light aerodynamically shaped. He goes on to learn how the inventor realized that an egg-shaped light with very specific dimensions is the only real way to optimize for strong winds. This is now a much more clearly stated invention: a traffic light optimized for wind that fits into a standard size light diameter.

There may be multiple claims here, but now the professional can restate the problem. The professionals say, "so wouldn't it be fair to say the problem was how to optimize the shape of a traffic light case, for multiple directions of wind, for traffic light sizes that are standard sizes". The inventor agrees then adds, "but that's just good engineering, right?". The professional agrees but adds, it may also be very well patentable, and could be broadly applied to outside ornaments, may relate to devices added to other stream flows, etc.

Now for the big question: If the professional was not around and we want a tool to help the inventor understand the invention, how would we start?

In comes Al! Let's first break down what the professional is doing in this instance. First, they go back into the history that the inventor had with the idea, followed by asking him/her about the component parts. The professional then moves on to detailed questions from the perspective of a technician when s/he probes deeper about novelty once they hear something that catches their ear.

One can easily see how this whole process can be replaced with Al. The first three steps would be replaced by the "history", "component part" and "technician input" fields. Given that the seasoned professional asks essentially the same questions after several hundred interviews, this is straightforward. At every step in the process, the Al system (in real time) detects when any type of novelty is input. For example, the algorithm would spot that "aerodynamic" and "traffic light", the two dominant concepts from the input, rarely appear together in the patent literature. This would trigger the "tell me more about aerodynamics" field from the Al engine. Thus, the Al engine is built on "thematic lines of questioning", from history, to a component part, to a technician, to a novelty response.



AI BASED PRIOR ART FOR ENHANCEMENT OF THE INVENTION DISCLOSURE

One thing that always occurs after the invention is "conceptualized" in terms of problem and novelty is to *hone in* on exactly what that novelty is. For inexperienced inventors, the determination of novelty through a prior art search is usually performed by a professional (patent agent, attorney, etc.). Only when the inventor's patent count approaches 15-20 does it make sense for the inventor to perform the novelty determination. Most of the time when conducted by the professional, the process of looking at "patent prior art" is expensive and takes huge amounts of time, both to conduct the search and get validation from the inventor. If this was real time and didn't require the drudgery of search, the disclosure development process could be quickened and have a high-quality result.

HOW AI CAN HELP:

Recalling our example, the AI engine noted novelty by picking up the lack of references that included both "aerodynamic" and "traffic light" concepts. After asking the inventor to elaborate on the two concepts, the AI presents the most relevant references to their description and asks them to describe the differences between their idea and the result set. A field box opens and the inventor discusses how their new egg shape appears to be different. Upon that, yet another search pops up showing references to egg shape and aerodynamics with yet another challenge, "how are you different than these references" with a memo input field. Now the inventor responds, drilling down of the aspect ratios

to the diameter of the light diameter. Now the AI engine, finding no more references, recognizes it has found the path of novelty. The system saves the dialog and the references and the AI engine might stop saying, "enough novelty found". The inventor is having a discussion with the virtual professional in a data driven way.

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AI BASED ENHANCEMENT OF THE CATEGORIZATION OF THE DISCLOSURE

In most paper and on-line disclosure forms, patent portfolios get built with archaic categorizations by administrators or counsels doing their best to save the invention. The purpose of these categorizations is for ease of retrieval in the future, say if a litigation opportunity for aerodynamic traffic lights arises.

More than many tasks, categorization is subject to human entry error, and creates a challenge when reports are generated about how the portfolio is developing or how has it been in the past. Today's workflow docket management systems are simply dropdown categorizations that are inflexible in real time, and don't allow for real novelty to be seen at the source its generated. Even worse, these workflow systems force categorizations in

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to pre-existing buckets imposing a one-dimensional view of the IP being developed.





HOW AI CAN HELP:

Our AI system could automatically ingest the company's internal classification data and easily determine the best category, creating a relevance to a set of other categories that are predefined. Over time this will show innovations that overlap in the company. However, the AI engine may start to see our aerodynamic traffic light as being a far distance from existing categories of "efficient traffic lights" or "weather resistant traffic lights" and create in the system an "aerodynamic sub category". In an artificially intelligent management system work flow docketing tool, this event would trigger either management or counsel to approve the new category. This very request alerts the company to "real novelty". So, an AI system, based upon its process to find novelty with the inventor can help the inventor know the right category to bucket his invention, recognizes real novelty immediately. Additionally, this leads the administrator or counsel to correctly bucket without human error and allows for richer multidimensional analysis of the docketing data.



AI BASED ENHANCEMENT TO ELIMINATE WILLFUL INFRINGEMENT ISSUES

Although there are many enhancements forthcoming for a world class Al engine for disclosures, one worth mentioning is putting the company at risk for willful infringement. This is clearly a divisive issue. Our interviews with many F500 companies creates a wide distribution of opinions from "we will never allow our inventors to read patents" to "willful infringement really isn't an issue". Strategically we could debate why two F500 companies could have such varied opinions, but we know one thing, if a company gets sued and willful gets proved, the company's policies will change.

But our inventor, whether first time or experienced, is far away from these debates. We know that the patent literature is the best resource to help the inventor invent, as the examiner will inevitably show patents for objections. Patent counsel cannot stop the examiner from citing, but counsel could stop the company from seeing the examiner's objections. In practice, this is rarely done, as usually preparation counsel has no knowledge of this exposure. Thus, willful business rules to bar inventors only show up again through counsel. As mentioned, we could debate this all and likely be a subject of another paper, but what is really needed is a real-time system, guided by the business rules of the company's strategies, to create the best protections possible for the company during the disclosure process. But mostly, it must be done in a way that doesn't bar the inventor from using the patent information.



HOW AI CAN HELP:

There are many things an AI engine can do, in real time, to assist with willful infringement issue. Suppose an administrator provides a list of companies or types of companies (e.g. independent inventors, large enterprises, etc.) where infringement is an issue. If our AI engine finds art from such companies in the novelty responses, a whole host of pre-selected business rules can apply. For example, a system message couple pop up that would urge the inventor to speak with the IP counsel, depending on how relevant the match was. Alternatively, if the user company is less risk averse, they may simply choose to strip out certain information within the patent document, such as eliminating certain claims but keeping others. The AI engine would essentially replace the workflow of security for the company. The entire "conversation" between the AI engine and the inventor is captured as record, which is constantly watching the risk to willfulness exposure.



FIGURE 2: Invention Disclosure Hype curve

Various instances of AI involvement in the invention and patenting process are highlighted on a hype curve. While things like "AI Writes Claims" and AI determines quality" are still early on the curve and only hypothetical, there are many instances of AI involvement that are already productive.

SUMMARY



The "Evolution process" to get to an Al disclosure writer, takes us from efficiencies of elimination to aggregation to automation, but artificial intelligence algorithms to be used in invention disclosure writing cannot be realized without carefully understanding the resultant "legal document" that is supported by the many data assets (data corpuses). We have suggested here that there is an overwhelming need for Al in the IP Department, of which invention disclosure is a perfect first realization of this artificial intelligence. The journey of improvements in invention disclosure documentation from history, the IBM Patent Factory of the 1990's, to today, still shows many issues left to improve speed, quality and relevance of the invention disclosure, the least of which is augmented the inventor with patent attorney skills.

We compared the static invention disclosure to an attorney interview to an Al based augmentation for the invention disclosure and found AI really is the future for all the issues to improve the process. Some of the areas to date, already seeing improvements are (1) AI based Thematic Inquiry of the invention disclosure, (2) AI based prior art for enhancement of the invention disclosure, (3) AI based enhancement of the categorization of the disclosure and (4) AI based enhancement to eliminate willful infringement issues. But we are just at the beginning as our "Invention Disclosure Hype curve" explains, with many future opportunities, all the way to the future AI invents itself.

Legit is an early-stage tech company that applies AI to the legal space, focusing on intellectual property.

ipCapital is a leading Innovation and IP Strategy firm, in Williston Vermont, with 20 years in business and serving over 800 clients, 15% of the F500 to date.