

Testing Artificial Intelligence in the United States Probation and Pretrial Services System

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Summary: The United States Probation and Pretrial Services System has data on millions of persons charged and convicted of federal crimes. The data describe more than just the background and conduct of the diverse federal defendant population. The information details the strategies and techniques used by generations of Probation Officers in carrying out their duties. In addition, the data shed light on the impact of policies and procedures of the Probation and Pretrial Services system over the years. If studied, they could further our understanding of criminogenic risk, the rehabilitative process and effective policy making. Unfortunately, that potential has not been realised. The data have proved too voluminous and unwieldy to process economically with traditional analytic methods. Newer technologies, such as Artificial Intelligence, promise to efficiently analyse incredibly large and diverse data sets. Could the power of Artificial Intelligence allow the treasure trove of Probation and Pretrial Services Data to be more fully utilised? That is what federal court officials sought to find out. As this paper outlines, the results were exciting, but not without caveats.

Keywords: Artificial intelligence, proof of concept, violent extremist, mental health at sentencing, Federal Probation, United States Probation and Pretrial Services.

Introduction

The United States Probation and Pretrial Services System, known simply as Federal Probation, provides information and recommendations to judges related to pretrial release and sentencing decisions. Federal Probation is also responsible for supervising persons conditionally released to the community pending trial or as part of their sentence.

Federal Probation has 7500 staff working in 400 locations across the United States and its protectorates. The Federal Probation caseload is diverse, and

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Probation Officers interact with 300,000 pretrial defendants and convicted persons a year. In terms of the supervision cases, the most common types of charges filed relate to drug trafficking, fraud and weapons possession. However, there are also persons under supervision for many other types of federal offences.¹ About half the supervision population has a prior criminal record, usually involving offences adjudicated at the state and local levels.

Administrative and logistical support for Federal Probation is provided by the Administrative Office of the United States Courts (AOUSC) in Washington, DC. The AOUSC is statutorily required to promote the efficient administration of Federal Probation.² In doing so, the AOUSC is committed to being an informed decision-maker, in part by developing technology to capture data and evaluate results/outcomes on an ongoing basis (Hughes, 2008). To achieve that objective, the AOUSC identifies and evaluates emerging technologies.

In its development of computer systems, the AOUSC has prioritised operational systems that reduce clerical tasks and therefore allow Probation Officers and other court officials to focus on the higher level professional tasks for which they are best suited (Judicial Conference of the United States, 1995).

Over the years, the AOUSC has piloted and operationalised scores of software applications to make Federal Probation staff more effective and efficient.³ Those systems now contain a wealth of information, more than 70 terabytes, related to the background and behaviour of millions of people charged and convicted of federal crimes. The data also reflect the strategies and activities of thousands of Probation Officers over the years who strove, with varying degrees of success, to promote law-abiding behaviour among persons supervised.

To contextualise how much data has been collected, the largest physical library in the United States is the Library of Congress. It has millions of volumes in its collection. If the Federal Probation data were printed out, it would fill the Library of Congress several times over.⁴

¹ One of the most common prosecuted offences in the federal system relates to immigration violations. However, those defendants are usually deported prior to service of any supervision term imposed. Consequently, relatively few cases on the federal supervision caseload have been convicted of immigration offences. For more information and details on the classifications of different types of federal offences, see <https://www.justice.gov/usao/page/file/1081801/download>

² Title 18 of the United States Code, Section 3672.

³ The Probation Automated Case Tracking System (PACTS), Decision Support System (DSS), Access to Law Enforcement System (ATLAS), Electronic Reporting System (ERS), Safety Incident Reporting System (SIRS), National Offender Defendant Search System (NODS) and Offender Electronic Payment Reporting System (OPERA), among others.

⁴ <https://www.worldatlas.com/articles/largest-libraries-in-the-united-states.html>; <https://blogs.loc.gov/thesignal/2012/03/how-many-libraries-of-congress-does-it-take/>

The immense size and varied format of the data collection have historically made it impractical to use for research purposes.⁵ A significant portion of the data was created specifically for individual case management rather than systemic analysis. Moreover, some data are stored in defined text fields, others in narrative fields, and a growing amount takes the form of imaged documents, photographs, videos and audio recordings. Significant manual effort would be required to standardise and categorise the data in order to leverage them, making them cost-prohibitive to use in studies.

One of the promises of Artificial Intelligence (AI) and related technologies is that, if properly employed, they could make data in varied formats more uniform. The data could then be categorised and assigned values to facilitate research. Consequently, the AOUSC sought to experiment with AI and related technologies to see if they could allow the wealth of Federal Probation data to be better utilised.

What is Artificial Intelligence?

Definitions and understandings of AI vary, but it can be understood as a set of technologies that allows for the speedy collection, analysis and presentation of large amounts of data (Stanford University, 2016). When coupled with hardware that has a large memory store and fast processing speed, AI software can examine data on previously unheard-of scales. Its power explains why AI is being applied in an increasing number of fields, including academia, business, government and medicine (Learnitude Technologies, 2018).

AI can process data beyond those manually entered into computer systems, including source documents, images, videos and audio recordings. Such functionality increases the amount of information available to help answer business questions while reducing the need for paperwork and non-contemporaneous notetaking, long the banes of Probation Officers wanting to focus on their case work. For purposes of the proof of concept, the components of AI used included optical readers, advanced text-analytics and machine learning.

AI is not a panacea. It is only as good as the quality and relevance of the data it is exposed to. The adage of 'garbage in, garbage out' still applies. Data quality is said to be one of the biggest AI challenges (Council, 2019).

⁵ Portions of the data have been used successfully, for example in the development of the Pretrial Risk Assessment and Post-Conviction Risk Assessments, but at relatively considerable time and expense.

While that challenge is somewhat mitigated with the Federal Probation data because the information was used operationally and in court proceedings, it and other obstacles remain. For example, AI 'learns' essentially the same way humans do, through training and experience, therefore the quality of AI's education impacts the quality of its outputs. In addition, to the degree humans are involved in the design and review of AI findings, our own human frailties will always be a factor. The human biases that many hope AI will avoid could be perpetuated in the technology through the learning and coding process.

Even one of the most intriguing features of AI, the ability to interpret photos, videos and audio recordings, has drawbacks from a policy perspective. The Federal Probation system is increasingly looking to video and audio recordings of interactions between Probation Officers and supervisees for research, for quality control and to provide performance feedback. The recordings are made with the knowledge and consent of those involved, but there are still concerns, which mirror those articulated in relation to body-worn video cameras commonly used by police in the United States. Critics argue that privacy concerns, cost and behavioural distortion outweigh the benefits of the technology (Lum *et al.*, 2019; ProCon.Org, 2018).

The behaviour distortion issue is particularly important in the probation setting. There is research suggesting that people behave differently when they know they are being recorded (Shaw, 2017). Consequently, video and audio data, if interpreted literally by AI, may be documenting feigned or unnatural behaviour rather than revealing the true behaviour patterns that probation officials need to understand.

Securing more familiarity with the strengths and weaknesses of AI and determining how best to apply it was among the reasons the AOUSC decided to test the technology via a 'proof of concept'.

Background on the proof of concept

The idea of using AI had been discussed by AOUSC officials for some time. There was initial reluctance to use a proof of concept, however, due to concerns about cost and training requirements. There was also fear that the nature of the technology could lead to over-reliance on mechanical outputs. Adding to the problem were emails from Probation Officers that included a link to a humorous scene between an ineffectual robot parole officer and the actor Matt Damon in the film *Elysium* (Blomkamp, 2013). The underlying message was that while technology can now handle many formerly human

tasks, activities requiring a deep understanding of human emotions may defy technological mastery (VanBenschoten, 2019).

Some concerns about AI have lessened over time. As to cost, it was found that many AI software applications were free and open-source, making them ideal for a proof of concept effort (Ayres, 2018). Also, some operational enhancements to existing analytical systems used by the AOUSC, SAP Business Objects specifically, also offered embedded AI features. Reducing hardware costs was the serendipitous availability of servers from other technology projects, and those servers being able to house the AI software with minimal reconfiguration.

As to the training requirement, members of the AOUSC technology staff were already studying and becoming familiar with AI for non-probation applications. Also, the AOUSC created a comprehensive Judiciary Engineering and Modernization Center, in partnership with the MITRE Corporation.⁶ With the Center and MITRE partnership came added expertise in AI (MITRE, n.d.).

The fear that technology would ruin the culture of the system was lessened by two factors. First, the proof of concept proposed by AOUSC technology staff involved a 'supervised model' where the machine did not operate independently, but rather was augmented and overseen by subject-matter experts drawn from the ranks of Probation Officers and AOUSC administrators. The involvement of experts with an understanding of not just the business needs but the culture of Federal Probation was deemed very important (Robinson, 2019). Second, and just as importantly, AI continued to prove itself in other business sectors and has become an accepted part of everyday life (Bradley, 2018).

Even within the federal government, 60% of agencies were already actively using AI for essential operations or planning to do so (Government Business Council, n.d.). Much of the federal government AI effort has had a law enforcement and research emphasis, consistent with what was sought to be done in Federal Probation (Bennett, 2019).

Three offices within the AOUSC joined forces to conduct the proof of concept. From the agency's Department of Program Services, there was the Probation and Pretrial Services Office (PPSO) and Case Management and Systems Office (CMSO). From the Department of Technology Services, there was the Technology Solutions Office (TSO). PPSO served as the 'business owner' for the project, being most familiar with the meaning and purpose of

⁶<https://www.mitre.org/centers/judiciary-engineering-and-modernization-center/who-we-are>

the source data. CMSO and TSO worked as the technical experts, each focusing on different business questions and operating independently to increase lessons learned from the effort. TSO also brought the expertise of MITRE to help with the proof of concept.

The questions to be answered as part of the proof of concept related to (1) identifying persons under supervision who may be affiliated in some way with violent extremism and (2) learning of trends related to the mental health of defendants at sentencing.

The CMSO team was tasked with using AI and chronological entries, which are explained in more detail below, to identify persons under supervision with ties to violent extremism. They were also asked to identify the extremist group or cause supervisees were associated with and to develop a ranking system to assess the reliability of the information examined.

The TSO team and MITRE were tasked with using AI and imaged presentence reports to determine the prevalence and nature of the mental health conditions and the treatment status of defendants at sentencing.

Common to both prongs in the proof of concept was a dynamic interactive model between subject-matter experts and the technology. The subject-matter experts developed word and phrase dictionaries, logic models and context clues for the AI to apply to the data.

One impressive feature was identifying a negation. For example, in relation to the mental health question, the AI successfully recognised the sentence 'the defendant did not report any mental health issues' meant that the person did not report a mental health problem, even though the words 'mental health' appeared.

The AI was also able to distinguish names of people from names of places and organisations. That proved important in the violent extremist inquiry. The AI correctly identified 'Isis Street' in San Francisco as a location. Similarly, using context clues, the AI appropriately labeled 'Isis Perez' as a person's name, while in other instances ISIS the organisation was accurately flagged as a violent extremist group.

The subject-matter experts also suggested mechanisms of display for the results of the AI analysis. The technology then examined all the data, developed algorithms and models, and displayed the data back to the subject-matter experts. The process was then repeated, and the results refined. So, key to success of the project was not the AI alone, but the subject-matter experts who guided it through the examination of the data.

Proof of concept Prong A: violent extremism

It is extremely important that Probation Officers correctly identify persons under supervision connected to violent extremism. Community safety and successful rehabilitation of the supervisee can hang in the balance. Making such a classification, however, is not easy.

Several factors complicate the identification of violent extremists. There isn't a single adjudicatory body that bestows or removes the label of extremist. Instead, law enforcement and corrections agencies use the classification differently and in the context of their respective missions. Moreover, even within given professions, definitions of violent extremism vary. The differences often turn on whether the classification is limited to persons directly involved in ideologically motivated violence or who incite such violence, versus those who themselves do not act violently for an extremist cause but indirectly support those who do (United Nations Office on Drugs and Crime, 2018). Federal Probation uses the broader definition, but takes role, relative culpability and current commitment level into account when acting on that definition.

There is also no definitive source of information to identify persons associated with violent extremism. Instead, multiple sources must be consulted, including government reports, court records, interviews with supervisees and those who know them, and surveillance. Relatedly, the reliability of the data sources must be assessed before drawing conclusions.

With these challenges noted, the proof of concept focused on the chronological entries of Probation Officers for all active post-conviction cases. Chronological entries are Probation Officers' notes related to criminogenic risk in the case, the supervision conditions imposed by the court and rehabilitative activities.

The power of AI was demonstrated in its speedy review of 26 million chronological entries related to 133,000 active cases. Using the initial data dictionary developed by subject-matter experts, it found 100,000 chronological entries that contained one or more words associated with violent extremism. Slightly more than 43,000 supervisees had one or more such chronological entries.

The subject-matter experts found, however, that the analysis was overly sensitive and missed context in some instances. A calibration of the algorithm resulted in the number of people with data linking them to violent extremism being reduced to 420. Confirmation supplied by Probation Officers

throughout the country indicated the algorithm used to identify the violent extremist from chronological entries was accurate.

Even in the few instances of 'false positives', Probation Officers reported that the supervisee had had extremist ties at one point but, due to advanced age, illness, renunciation, or past co-operation, was not considered an active threat. The analysis also revealed that the extremist affiliations were, in order of prevalence: sovereign citizens; hate groups; religious extremists; and social cause extremists. The cases were spread throughout the country and protectorates, but with more densely populated states having – in raw numbers – more violent extremists.

To enhance the results further, subject-matter experts recommended that data sources beyond the chronological entries be considered by the algorithm. The subject-matter experts also indicated, in the case of violent extremism, that the supervised model of AI should continue to be used. With new extremist groups forming and old ones losing strength, data dictionaries and other source material for the AI will need to be constantly updated (Brennan, 2019).

Proof of concept Prong B: mental health at sentencing

The mental health condition of a defendant at sentencing is an important consideration. Under the United States Sentencing Guidelines, mental health condition may warrant a custody term outside the otherwise suggested range and is relevant in fashioning conditions of any supervision term imposed.⁷ Information as to mental health trends among defendants is also important to probation administrators. The information can help ensure that adequate services are available when defendants commence supervision, whether it be immediately after sentencing or years later after serving a prison term. Moreover, the link between mental illness and criminogenic risk is often misunderstood and requires ongoing study and discussion (United States Department of Health and Human Services, 2017).

Federal Probation closely monitors mental health issues on an individual case basis, but current systems do not easily allow for aggregation at the regional or national level. As a result, identifying trends and facilitating research has been difficult for the AOUSC. To address that deficit, AI was tasked with analysing the mental health and related sections of 11,243 randomly selected presentence reports. Notably, the documents were stored not in paper but as images in Portable Document Format (PDF).

⁷ USSG § 5H1.3, <https://www.ussc.gov/guidelines>

A descriptive analysis of the data revealed that the mental health section of presentence reports is usually shorter than other sections. Presumably due to confidentiality rules and other issues that restrict Probation Officer access to mental health information, the mental health sections averaged 81 words compared to 128 words in the substance abuse section.

In 36% of the cases, a mental health issue of some kind was cited. One in five defendants had a formal mental health diagnosis. Where specific condition types were cited, depression and anxiety were mentioned most commonly, in 21% and 16% of the cases respectively. Alarming, 26% of presentence reports mentioned the defendant having suicidal ideation. Clearly the stress of being sentenced seems to trigger, or aggravate, depressive, anxious and suicidal issues in defendants.

The next most common diagnosed conditions were bipolar disorder and attention deficit disorder, both cited in 6% of the cases, and post-traumatic stress disorder, noted in 4%. Prescriptions were mentioned in 19% of the reports, and the medications were consistent with the mental health conditions noted above. Specifically, the most prescribed drugs, in order, were Prozac, Ritalin, Seroquel and Xanax.

The AI analysis revealed that Probation Officers were able to verify mental health information through medical professionals or other third parties in only 17% of the cases citing a treatment history. Most of the information in the reports related to mental health was self-reported by defendants. That low level of verification likely stems from a combination of factors, including confidentiality surrounding treatment records, varied disclosure procedures required by treatment providers and the short time frames Probation Officers have to complete reports.

Due to the common link between mental health and substance abuse, the AI analysis was expanded to examine substance abuse data. The analysis revealed that the most common drugs abused were marijuana, alcohol, cocaine, prescription drugs, methamphetamine and heroin, in that order. The onset of substance abuse spiked between the ages of 10 and 25, and it peaked significantly between ages 16 and 18.

Because time allowed, the AI analysis was also expanded to include the criminal history section of the presentence reports. It found that 53% of the defendants had some form of prior criminal record. Of those with a record, the average number of arrests or adjudications was five.

The subject-matter experts who worked on the mental health portion of the proof of concept reported that the AI analysis proved both powerful and

useful. However, as with violent extremist analysis, the subject-matter experts indicated that ongoing review of data dictionaries, expansion of data sources and a strong feedback loop with users are needed for the technology to achieve its full potential (Levenson, 2019).

Cost analysis

One of the reasons Federal Probation data have been impractical to use on a systemic scale has been cost. As they are stored in varied formats and collected more for operational rather than research purposes, considerable time and effort would be involved in leveraging the data using traditional analysis methods (e.g. manual coding). The advertised strength of AI, in contrast, is the ability to process large amounts of data faster and more consistently than through traditional manual methods.

To manually examine, code and study the millions of chronological entries and thousands of the presentence reports in the proof of concept would have taken approximately 87 'work years', with an estimated cost (predominantly labour) of \$6.9 million.⁸ Considering the relatively narrow scope of the proof of concept, it has been cost-prohibitive previously to process all the Probation and Pretrial Services data.

In relation to the AI analysis, it was estimated that three work years were dedicated, including the technical personnel and subject-matter experts. The labour costs then totalled approximately \$240,000. Software and hardware costs were approximately \$10,000, bringing the total estimated cost to \$250,000. Therefore, at roughly 3% of the price of doing it manually and at a fraction of the time, the AI proof of concept revealed insights into violent extremists under supervision and the mental health condition of persons being sentenced in federal court.

Consequently, AI proved substantially more economical and efficient than traditional manual methods to process the data. Another important consideration is the cost of any replication. To run the AI analysis again would have minimal cost, while a manual effort would incur all the costs associated with the original effort.

Conclusions and recommendations

The proof of concept successfully demonstrated the ability of AI to process large amounts of diverse data in an economical fashion. The technology offers

⁸ A work year is considered 1880 hours, or one person working full-time. To compute cost, the salary and benefits for an employee in a work year were estimated at \$80,000.

unprecedented opportunities to learn from past cases, to make Federal Probation more efficient and to further several public interests. What is even more exciting is that the technology is expected to improve and become more accessible over time (Michaels, 2019).

However, the proof of concept also affirmed that there are limitations to the technology. The pilot involved only portions of the mass of data held by Federal Probation and, without the additional data sources included in the analysis, all conclusions are preliminary at best. Moreover, the technology, as powerful as it is, clearly needed ongoing interaction with subject-matter experts to be effective.

With an evolving work environment, the 'supervised model' is deemed a necessity at this stage. In fact, no one involved in the project advocates for the technology to replace professional judgement on matters of importance. Instead, they universally view AI as a valuable tool to help in the exercise of that judgement and to remove rote work best handled through automation.

The final recommendations of the AOUSC team that conducted the proof of concept for other entities interested in AI is to invest in the front end to ensure business needs are clear and that the AI is properly 'educated' about the data it will be processing. Again, there is strong support for the 'supervised model' of AI with the technology and subject-matter experts working together, rather than independently.

References

- Ayres, C. (2018), '6 pros and cons of open source software', available at <https://greengarageblog.org/6-pros-and-cons-of-open-source-software> (accessed 19 July 2019)
- Bennett, S. (2019), 'How artificial intelligence can transform government', available at <https://www.nextgov.com/ideas/2019/01/how-artificial-intelligence-can-transform-government/154462/> (accessed 19 July 2019)
- Blomkamp, N. (director) (2013), *Elysium* [motion picture], available at <https://www.youtube.com/watch?v=JzF5VawGgiA> (accessed 19 July 2019)
- Bradley, R. (2018), 'The manifest', available at https://medium.com/@the_manifest/16-examples-of-artificial-intelligence-ai-in-your-everyday-life-655b2e6a49de (accessed 19 July 2019)
- Brennan, P.S. (2019), Interview with Probation Administrator, Administrative Office of the United States Courts (M.G. Rowland, Interviewer), 29 May
- Council, J. (2019), 'Data challenges are halting AI projects, IBM executive says', available at <https://www.wsj.com/articles/data-challenges-are-halting-ai-projects-ibm-executive-says-11559035800> (accessed 19 July 2019)

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- Government Business Council (n.d.), 'Is the Federal Government ready for AI?', available at <https://www.govexec.com/insights/federal-government-ready-ai/> (accessed 30 May 2019)
- Hughes, J.M. (2008), 'Results-based management in Federal Probation and Pretrial Services', *Federal Probation*, vol. 72, no. 2
- Judicial Conference of the United States (1995), *Long Range Plan for the Federal Courts*, Washington, DC: Administrative Office of the United States Courts
- Learntitude Technologies (2018), 'Applications of Artificial Intelligence in top 10 areas', available at: <https://learntechx.com/blog/applications-of-artificial-intelligence-in-top-10-areas> (accessed 19 July 2019)
- Levenson, S. (2019), Interview with Probation Administrator, Administrative Office of the United States Courts (M.G. Rowland, Interviewer), 29 May
- Lum, C., Stoltz, M., Koper, C.S. and Scherer, J.A. (2019), 'Research on body-worn cameras', *Criminology & Public Policy*, vol. 18, issue 1, pp. 93–118
- Michaels, C. (2019), Interview with Deputy Chief Technology Officer, Administrative Office of the United States Courts (M.G. Rowland, Interviewer), 30 May
- MITRE (n.d.), 'Judiciary Engineering and Modernization Center', available at <https://www.mitre.org/centers/judiciary-engineering-and-modernization-center/who-we-are> (accessed 19 July 2019)
- ProCon.Org (2018), 'Police body cameras: top 3 pros and cons', available at <https://www.procon.org/headline.php?headlineID=005399> (accessed 19 July 2019)
- Robinson, C. (2019), Interview with Division Chief, Administrative Office of the United States Courts (M.G. Rowland, Interviewer), 31 May
- Shaw, J. (2017), 'The watchers: Assaults on privacy in America', *Harvard Magazine* (online), January–February
- Stanford University (2016), 'One Hundred Year Study on Artificial Intelligence', available at <https://ai100.stanford.edu/2016-report/section-i-what-artificial-intelligence/defining-ai> (accessed 19 July 2019)
- United Nations Office on Drugs and Crime (2018), "'Radicalization" and "Violent Extremism"', available at <https://www.unodc.org/e4j/en/terrorism/module-2/key-issues/radicalization-violent-extremism.html> (accessed 19 July 2019)
- United States Department of Health and Human Services (2017), 'Mental health myths and facts', available at <https://www.mentalhealth.gov/basics/mental-health-myths-facts> (accessed 19 July 2019)
- VanBenschoten, S. (2019), Interview with Branch Chief, Administrative Office of the United States Courts (M.G. Rowland, Interviewer), 31 May