ACCELERATE

VOLUME 3 • ISSUE 2

Inspection AI + CUSTOMS

Accelerate Secure Trade

S2 GLOBAL
An OSI Systems Company

AI TO ACCELERATE SECURE TRADE

Everyone is talking about AI. But what does that actually mean and how does it affect Customs? Digital Transformation for Customs has brought more technology to points of entry in order to increase the number of inspections performed on cargo and vehicles. Integrated inspection processes that keep trade flowing have emerged to augment manual checks formerly based on instinctual risk analysis.

With these types of operations, opportunities to capture much more data for new and improved algorithms is available. Agencies can now verify trade to increase revenue, intercept contraband and ensure a secure trade process at a higher level.

The World Customs Organization (WCO) is shining a light on how technology can assist their members by increasing capacity. When many agencies have employed technology opportunities abound:

- Data collection for algorithm development
- Increased compliance with international standards
- Data sharing opportunities

In this issue we will take a look at aspects of artificial intelligence and algorithms for inspection applications furthering Customs capabilities and how AI can be developed to support the work officers perform day to day.

At the end take a fresh look at our products facilitating AI + Customs, CertScan to integrate operations, S2 University to train inspectors and S2 Data our algorithm development data service.

S2 Global *provides an intelligent platform that delivers accelerated integrated inspection services to secure trade, transport and events.*

S2 Global
United States of America
www.screeningsolution.com

FEATURED ARTICLES

ACCELERATE

VOLUME 3 • ISSUE 1

Inspection AI + CUSTOMS

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In the world of artificial intelligence, data is the most valuable asset.

ChatGPT, the artificial intelligence tool was trained using a diverse and extensive corpus of text from the internet pre-2021. From there it was refined into a static tool for interacting with its knowledge. If you have tried ChatGPT you may have experienced its ability to just make things up, even drawing conclusions that don't quite make sense. But, it's young and doesn't have access to live information, so lets call this a first step into the possibilities for the way we interact with shared knowledge online.

Another very interesting AI model was developed by a team at Massachusetts Institute of Technology (MIT) and is an image based tool for detecting lung cancer in x-ray scans. The model, called Sybil was trained on hundreds of labeled CT scans with visible cancerous tumors to ensure it would be able to accurately assess cancer risk. By using this detailed method, the model was able to develop some predictive capabilities as to which lung was most likely to develop cancer.

Data is essential to developing algorithms. Even more labeled x-ray images would be required for cargo due to:

- Complexity of cargo shipments including mixed commodities
- Identification of thousands of goods and how they look on an image
- Inclusion of shipment data from text resources

With an integrated inspection program collecting data from more trade, it is possible to collect this information and have a reliable library to build detection algorithms for Customs, accelerating secure trade.

The CertScan integration platform performs data collection on every aspect of your inspection.

DATA DRIVES ALGORITHMS THAT DELIVER INSPECTION EFFICIENCIES

Data drives algorithms to make connections, find relationships, and — perhaps most importantly in the security screening world — evaluate scenarios to drive decision-making. The result is a safe port of entry. Success rests on deep, solid and varied data.

An initial trained dataset provides the connective tissue that will lead to successfully building AI systems and responses. The data serve as the foundation for a growing information library to enable agile, automated threat assessments.

Trained by data scientists and image analysis experts, algorithms need to "learn by example" to improve true positive accuracy. Collecting high-quality, consistent data is critical. Once the algorithm is trained, real-world data is measured and collected from the field and used as part of a positive feedback loop to provide evaluation and improvement.

When it comes to security screening, trained data provide the building blocks that enable the creation of intelligent systems that can successfully detect contraband or achieve other mission-critical goals, to supplement or as needed override sometimes faulty human judgment. Algorithms that build upon a weak data foundation can lead to subtle vulnerabilities in the screening process ultimately will emerge, failing to accurately read a scenario and at times posing security threats.

For example, a dataset may consist of hundreds or even thousands of X-ray scans portraying a diverse set of threats – firearms, cigarettes, unexpected cargo, possible smuggled goods -- in a wide array of contexts. These are then used to train object detection models.

The CertScan® integration platform can deploy image and data algorithms to aid operators in image interpretation and threat detection. Image algorithms help highlight potential threats and contraband, allowing image analysts to be more efficient.

With a powerful and flexible integration platform such as CertScan, the screening operation and S2 University trained analysts be assured that there is continuous improvement in detection algorithms through ongoing incorporation of real-world images and scenarios.

Validating: Good Data for Successful Algorithm Application

A lot of systems integrated into one leave open the possibility for vulnerabilities. Before algorithms can be applied to sensor or text data, ensuring their quality meets the same standards as when the algorithm was developed is prudent. If the data is not on par it can result in:

- higher false results
- low trust of the inspection and
- increased workloads overall

There is a way to mitigate these issues: apply a pre-algorithm data quality check.

In a fast paced operational workflow simultaneous activities should not be hindered by bad data. With continuous data monitoring implementing algorithms into your inspection process will:

- Decrease probability of a biased classification
- Determine algorithm performance issues
- Identify drifts in algorithm performance

As inspection algorithms become mainstream, assessing the current state of sensor hardware and data systems is paramount. Is leaving your inspection operation at the mercy of unchecked AI good enough to carry your program into the future?

If the answer is no, you must consider the opportunity to evaluate the data before an algorithm is applied. Implement a data quality check into the workflow that will ensure your inspections are performing at the highest levels. A

CertScan IQ performs a quality check on data to maintain the integrity of fast moving inspection operations.

AI – IT'S PROBABLY NOT WHAT YOU THINK

by Jeff Goldfinger, Founder, Xtra Mile Training and Development

As a computer scientist by education, I tend to follow the latest technology trends. As an aerospace, defense, and security industry consultant, I restrict myself to those that are meaningful in our B2B and B2G domains. As a business development educator and professional development coach, I then must convert the, often cryptic, language of the tech products to actionable recommendations for my clients.

Since the debut of ChatGPT and Tesla's recent preview of their Full Self Driving (FSD v12) software, a narrative around incorporating AI for the customs community has reached a fever pitch. Yet, while reading the wide spectrum of questions being levied at the private sector from public sector program managers and procurement officials worldwide, I felt compelled to write this article to both educate and (re)set expectations.

A BRIEF HISTORY OF AI TIME

The first formal mention of computer-generated intelligence came from Britain's Alan Turing 75 years ago. Although science fiction movies of the 1950s and 60s anticipated a future full of AI-assistants (e.g., Lost in Space, Star Trek, 2001: A Space Odyssey), the decades since Minsky, Edmonds, and von Neumann's invention of the first neural network computer in 1951, have seen only small, evolutionary steps.

Until, of course, the release of GPT 3.5 went viral in November 2022.

To truly understand and exploit the power of AI, it might first be useful to compare how computers learn to how humans learn. In both cases, there are three essential components—signals from the outside world (data), thinking to make sense of the signals (algorithms), and a processor that performs the sensing calculations (compute).

Regardless of society's rapid growth over the past 5,000 years of recorded history, the algorithms in our brain have hardly changed since the emergence of imaginative humans around 50,000 years ago. Nor has our brain's compute power going back at least 250,000 years when our species first emerged on the African plains.

Not so for computers. With the invention of modern transistor circuit computers, in accordance with Moore's Law, processing power has doubled roughly

every 18-24 months. And, while human memory capacity remains stagnant, digital data storage has become exponentially cheaper in accordance with Wright's Law, allowing all manner of public and private institutions to collect huge volumes of user data.

THE HUMAN AND AI LEARNING LADDER

As infants, we first learn to make sense of the world by observing our surroundings without doing much more than collecting all the inputs from our five senses and putting them into distinctive chunks—how many things move or don't move, taste good or bad, make us cry or make us laugh. This is our brain's way of describing the world we inhabit.

Business operations are no different. The infant stage of computers in business allowed the development of "dashboards" to display everything that had happened. How many things were sold or not sold, made better or made worse, broke vs. repaired, cost money vs. made money. Today, there are all manner of computer-based tools to organize your dashboards such as Microsoft's PowerBI, Salesforce's Tableau, and Google's Looker. Just about every profitable business of any size has taken this first step on the learning ladder called "Descriptive" analytics or "What happened in my organization?"

Sidenote, why do you think they call these business tools dashboards? A car's instrument panel, its dashboard, is a BI tool. It's telling you what has happened with your car—how many miles have been driven, how much fuel you've burned, how hot or cold is the engine, etc.

As children, after we learned to walk, our brain started anticipating what would happen next. If I touch that hot stove, I'll burn my hand. If I run too fast, I might fall. If I eat that rotten tomato, I'll get a stomachache. There are now tools in everyday life and business that are also designed to predict the future. Cars can now not only tell us how many miles we've driven but how many more miles we can drive until our gas tank runs dry or battery pack is exhausted. Retailers use the Descriptive BI data to feed algorithms to predict how many items to stock their shelves with and at what price. Publicly traded companies are required by law to predict what their future earnings will be and make that knowledge public.

This is called the Predictive stage of AI learning or "What is likely to happen?" Predictive algorithms are rarely, if ever, 100% accurate. So, the goal of every organization is to train the algorithms to continue shrinking the error bars. This can be done manually by financial analysts as they tweak the formulas in their spreadsheets or by use of machine learning where the algorithms learn on their own based on feedback loops from the Descriptive BI tools.

As teenagers, we start developing a sense of autonomy because not only can we now predict what might happen, we start planning which choices to make. For example, my son's descriptive brain tells him that he had a test every month in science class so his predictive algorithm lets him know that he will likely have a test next month so he should probably study to improve his outcome—a prescription to achieve a better result (while avoiding his father's ranting to do the same).

Data scientists call this the Prescriptive stage of AI learning where the algorithm answers the question: "What should I do about what's going to happen?" As a simple example, many cars have a "Get Service Now" light that illuminates when the car's Descriptive and Predictive algorithms detect signals that are abnormal and troubling. As a more sophisticated example, online retailers and streaming video services now regularly have "Recommended for You" choices based on your prior buying habits (Descriptive BI), how accurate their prior predictions were, and combing through similar data from others just like you—age, level of education, where you live—from the personal profiling data they collect or purchase from data aggregators.

As adults, around age 25 or so, our brains are now fully formed and the "Executive Function" part of our pre-frontal cortex is finally able to, as neuroscientists would say, "do the hard but right thing" such as not driving too fast on snow-covered roads or, in my case, eat more salad instead of pasta. For computers, the best example of this level of AI is the development of fully autonomous, driverless automobiles. While some cars can now automatically parallel park themselves, a few companies like Tesla, Cruise, and Waymo, have demonstrated the capability to enter a destination and have the car navigate there with little or no intervention.

We have now reached the Semantic level of AI, where the computer reacts to a command within a particular social context. The car cannot just drive straight from point A to point B, it must observe traffic lanes, stop signs, crossing traffic, obstacles, etc. This is what made ChatGPT v3.5's debut so significant. It was the first time that you could ask the computer to do something practical—write me a business plan, correct my resume—in the Semantic context of feeding it your business idea and your employment history.

But just like fully adult humans make mistakes, so does Semantic AI. Waymo and Cruise vehicles still get stuck in the middle of roads when their software gets confused and Tesla's FSD still requires occasional intervention. We humans (mostly) learn from our mistakes as do more sophisticated AI algorithms. There's already version 4.0 of GPT which corrected some of version 3.5's errors and Tesla's FSD v12 entirely abandoned a rules-based approach in favor of 100% neural networks, far more akin to human learning than any previous version.

I SEE AN AI IN YOUR FUTURE

As we humans mature from infancy to adulthood, learning becomes increasingly complex requiring access to more and more data and more and more energy (best to budget now for your teenager's voracious appetite). While our brains represent only 7% of our body's volume, they consume nearly 20% of the energy (via oxygen and glucose). Similarly, at each stage of the learning ladder—Descriptive BI, Predictive, Prescriptive, and Semantic—the amount of data consumed, and computational resources required grows exponentially. This is why we can find hundreds of Prescriptive BI tools on the market but less than a handful of Prescriptive.

What then is the meaning of all this for the customs community? There are three key challenges that must be addressed.

First, computational power is not going to be solved by the limited resources of government agencies and customs equipment manufacturers. Let the chip

manufacturers and cloud computing providers solve that for us.

Second, leverage the extraordinary advantage computers have over humans in sensing. While the five human senses have a very narrow range and limited sensitivity, digital sensing systems can scan the entire electromagnetic spectrum from radio waves to gamma rays, from infrasound to ultrasound, and with airborne particle sniffers that are more sensitive than even a bloodhound's nose (which is already 10,000 times more sensitive than a human's). Vast amounts of text and imagery at ports of entry are already readily available. The key question is what is being done with it all?

The community consensus seems to be to keep the data in their existing silos. Vendors stick with propriety data formats and customs agencies are timid about cross-border data sharing agreements. This has led to suboptimal resource utilization at POEs where many still operate under the assumption of assigning one agent to one scanner. This naturally has led to fractional inspection rates (1 – 5% at most crossings) or bottlenecks that severely delay the flow of commerce.

Third, AI algorithms at any of the three levels of autonomy (Predictive, Prescriptive, and Semantic) require not only large amounts of data but the data must be curated. Imagine training a car's autonomous driving on examples from crappy drivers. When Tesla first allowed consumers to install their Beta versions of FSD, before accepting their payment, they required the drivers to achieve a specific "safety score" so that the algorithms were training on high quality, real-world driving examples.

Fourth is the matter of setting expectations. While there are many Descriptive BI tools in use today by customs agencies, there are far fewer Predictive tools, perhaps only a handful of Prescriptive tools, and zero Semantic tools. By some estimates, the ability to replace human agents with Semantic AI is at least 3-5 years away and more likely a decade or more. Don't believe any vendor that tells you otherwise.

ACCELERATING THE ASCENT UP THE AI LEARNING LADDER

This is where I, as an industry consultant, tip my hat to S2 Global for their CertScan AI integration platform, CertScan-Data tool for AI-developers, and S2U for their agent training programs. They have made, in my opinion, the absolutely correct strategic decision to produce an AI-enablement platform. To borrow from an old ad campaign, "They don't make the AI algorithms, they make them better." By providing access to millions of quality integrated data packages (text + imagery) to vendors and then validating the AI algorithm once in use, they have demonstrated that 100% inspection rates, increased revenue collections, and improved operator performance can be achieved today. Upon reading the testimonials from their customers and learning for myself the true power of their solution set, I can speak with confidence that if you want to climb the customs-centric AI ladder, S2 Global can help you figure out where you currently stand and how best to accelerate your ascent. That's why I chose them as my newest client. A

AGENTS WITHOUT TRAINING IS LIKE A POE WITHOUT INSPECTIONS

by Jeff Goldfinger, Founder, Xtra Mile Training and Development

With the debut of Open AI's ChatGPT in November 2022, and worldwide consumer expectations of driverless automobiles, incorporating artificial intelligence (AI) is one of the most talked about subjects in nearly every industry. The customs community is no exception (see related article "AI – It's Probably Not what you Think"). Anecdotally, one of the most asked questions by the public sector is, "Can (or when will) your AI algorithm replace human agents?"

I submit that is the wrong question to be asking.

Before revealing the more relevant concern, it might be useful to take a brief stroll down memory lane.

The inspiration for the title of this article comes from a 1970s advertising campaign in the U.S. by the Florida Citrus Commission with the tagline: "Breakfast without orange juice is like a day without sunshine." The implication was that having a more positive daily life required inclusion of a specifically essential ingredient at the start.

The claim of this article is that a similarly essential ingredient is responsible for producing positive inspection outcomes every day.

Therefore, instead of inquiring about just one specific data point for AI implementation, we should be asking the more strategic question, "How much training do agents—both human and artificial—require to be most effective?"

It took nearly seven years, over $11Bn (USD), and billions (perhaps even trillions) of text-based data to train ChatGPT's large language model (LLM) to achieve its current level of natural language processing (NLP). Regarding autonomous vehicles, self-reporting by Tesla suggests it took more than ten million video clips to train their latest version of full self-driving (FSD v12). Yet, LLMs can produce incorrect answers and driverless cars require continuous operator attention and occasional intervention to remain safe.

In one particularly notable example, New York attorney Steve Schwartz used GPT to help him with research on a client's personal injury case. Unfortunately, GPT fed the esquire false case law, which he naively trusted to include in one of his court filings resulting in sanctions and a fine by the aggrieved judge. More humorously, in April 2022, a police officer in San Francisco, California, attempted to issue a citation to what turned out to be a driverless car after its internal logic caused it to behave erratically at an intersection.

Thanks to Mr. Schwartz's example, while many companies are now finding ways to incorporate the capabilities of NLPs into their daily business operations, there are few if any accounts (GPT or otherwise) where they completely replace humans. Rather an NLP may be tasked with composing an initial draft document (e.g., business plan, resume, legal contract, computer code) with a human providing the final editing and approval. Conversely, NLPs are being used to proofread and improve a human's first draft. In both cases, AI should be rightly considered solely as a complementary technology.

As for driverless automobiles roaming around, except for Waymo and Cruise in San Francisco, California, widescale adoption and regulatory approval of such capability is likely a decade or more in the future, according to most auto industry analysts.

I assert that the simple reason for this lack of trust in AI should focus on training. As cited above, all AI algorithms, whether machine learning- or neural network-based, require training using vast amounts of data. While essential, database size alone is insufficient. One of the preeminent edicts taught to every computer coder is "garbage in, garbage out"—a computer's output is only as good as the input its fed. Therefore, in addition to quantity, the quality of the training dataset is even more crucial.

In Tesla's case, the millions of training videos were collected, curated, and labeled by humans, from the billions of miles that their customers had been driving. But not just any customers. To be included in the pool of acceptable drivers, participants of the initial beta version of the software had to have a "safety score" (i.e., quality) of 90 or above. As the software improved, Tesla wanted to make sure to test it against a broader sample of edge cases (rare, complex situations) so they later relaxed the criteria to 80 or above.

Think about the self-imposed financial implications of this restriction. The company was willing to forgo $15,000 of (almost pure profit) revenue per install, for years, just to ensure that the algorithm was properly trained. Not until November 2022, nearly six years after its initial debut, was Tesla sufficiently confident in the quality of their algorithm to eliminate the safety score mandate. Yet it is still called FSD "Beta" as they continue testing the quality against a near infinite sample of both good and bad human reactions.

By now you should have some sense that AI agents will likely not replace human agents for customs applications for many, many years to come (perhaps a decade or more). Furthermore, to have even a remote chance at such cost displacement will require a substantial, on-going investment in the production of high-quality training data derived from even higher quality current execution by human operators.

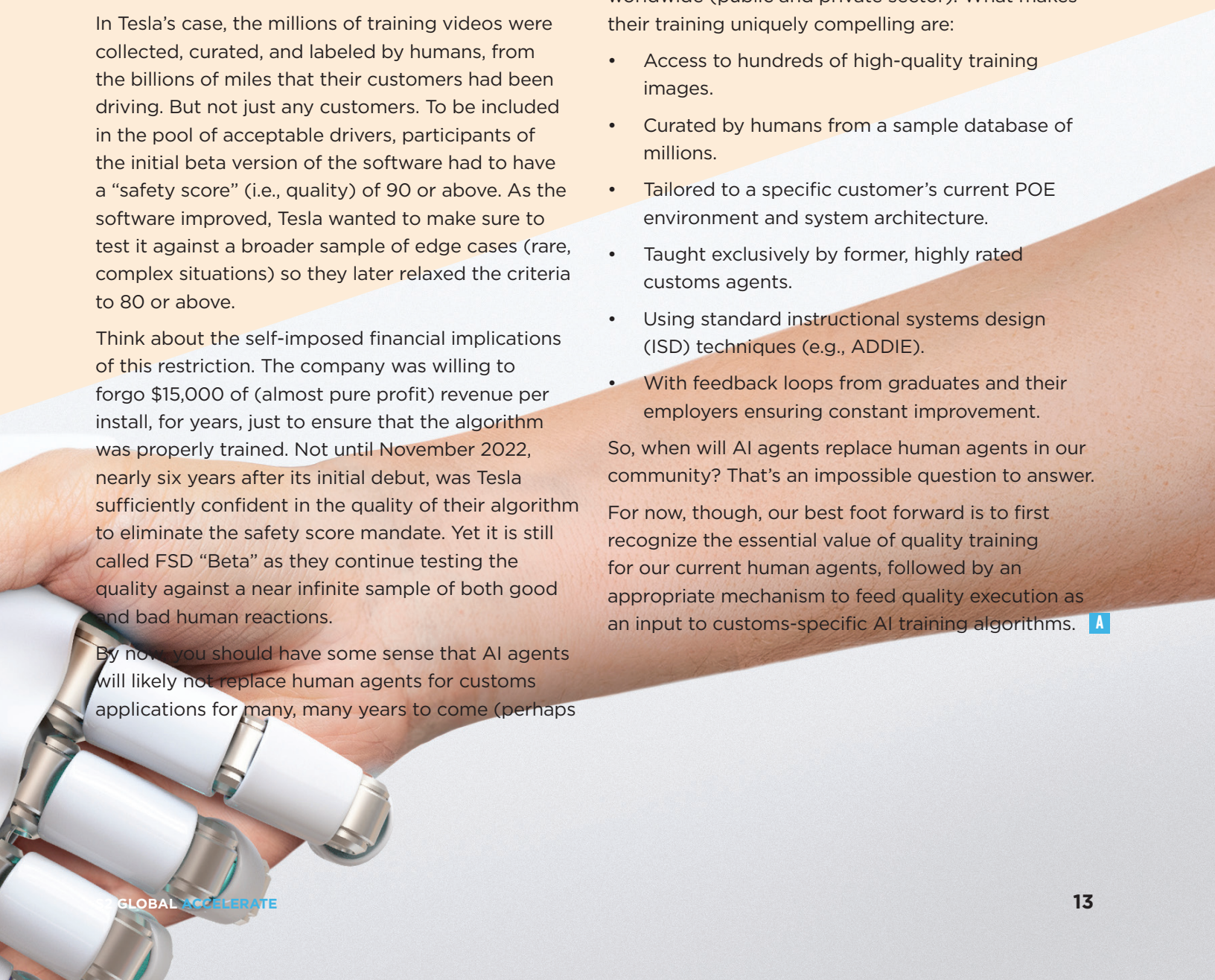
That then forces us to examine the state of today's training of human agents, for without examples from a pool of customs officers with high quality "scores" of their own, it will be impossible to produce accredited (i.e., trustworthy) AI agents. This is where the experience of S2 Global's S2 University (S2U) can provide us with the most appropriate example to emulate on a global scale.

Since 2010, S2U has delivered certified training to over 2,000 agents from security institutions worldwide (public and private sector). What makes their training uniquely compelling are:

- Access to hundreds of high-quality training images.
- Curated by humans from a sample database of millions.
- Tailored to a specific customer's current POE environment and system architecture.
- Taught exclusively by former, highly rated customs agents.
- Using standard instructional systems design (ISD) techniques (e.g., ADDIE).
- With feedback loops from graduates and their employers ensuring constant improvement.

So, when will AI agents replace human agents in our community? That's an impossible question to answer.

For now, though, our best foot forward is to first recognize the essential value of quality training for our current human agents, followed by an appropriate mechanism to feed quality execution as an input to customs-specific AI training algorithms. A



CertScan® Inspection Integration Platform

Enterprise software to control your security operation, capture data, employ algorithms, empower your workforce, reduce friction, and increase revenue.

CertScan & Customs

CertScan, by S2 Global, has proven to substantially increase Customs inspection rates (from 5% to 100%), throughput (by 4.5x), security (by 2.8x), and revenue (by 2x) through our hardware agnostic integration platform. With existing service experience at sixty major border crossings worldwide, we continue to improve the functionality, agent experience, and metrics. Its secure cloud architecture and software-defined workflows integrate trade data, adjacent inspection sensors, and imagery from disparate sources into a common viewer for both onsite and remote validation. Combined with professionalized training from our colleagues at S2 University, your inspection workforce is appropriately scaled for smooth and secure trade.

CertScan delivers a complete, secure solution for Customs inspectors and security professionals seeking to perform at the highest levels.

The results:

- Accelerated Inspection
- Higher Throughput
- Increased Seizures
- Improved Compliance
- More Revenue Collection

CERTSCAN ACTIVATE

Integrate with any brand of Non-Intrusive Inspection equipment, complimentary sensors, and data systems.

Increase inspection quality and capture operational efficiency through CertScan's workflow.

Collect every data point for each inspection and access analytics, reporting and auditing capabilities.

Deploy on prem, in the cloud or as a hybrid solution, always under stringent cyber security protocols.

Customize your dashboard.

Adjudicate onsite or remote.

CERTSCAN OPTIMIZE

Label data for personalized algorithm development.

Use CertScan AI Services with localized and third-party algorithms in the workflow.

Support data integrity with CertScan IQ by monitoring sensor and data for standards matching each algorithm.

Share data with security partners.

CERTSCAN TRAINING

Get the most out of CertScan with role and image analysis training from S2 University.

Keep everyone in the operation informed of noteworthy inspections with the Be On the Look Out 'BOLO' notification system.

S2 GLOBAL
An OSI Systems Company

Supercharge Your Inspection Capabilities

Skill development is essential for effective cargo and vehicle inspection. As shown through measurable results, S2 Global empowers students to approach each inspection with unwavering confidence. Take a look at what they have to say below, then reach out to sign your team up for training that will supercharge your inspection capabilities.

S2 University Certifications
for all X-ray system brands

S2 Global delivers training so that customers become experts at inspection. Our courses are based on field-proven, unique principles including:

- Image and data from real-world inspection situations – not simulations. S2 training is as close to actual work experience as possible.
- Instructors with decades of operational and field experience working with US and International Customs, Defense and Trade industry.
- Memorable courses with measurable improvement in student results.
- Training in person and online at S2University.com so students can complete courses and become experts in their field.

S2 UNIVERSITY

"Best training course I have had in my 19 years of service."

— S2 UNIVERSITY CARGO & VEHICLE IMAGE ANALYSIS STUDENT, CANADA BORDER SERVICES AGENCY

Algorithms are important for the industry to meet the challenges of inspection that's why we now have a service to access labeled data sets for algorithm development.

S2 Data

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