ELEVATOR PITCH

The Customer: Organizations or individuals seeking information on automobiles from an organized, curated, and searchable platform.

- Advertisers: Automobile-related businesses or advertisements featuring cars require authenticated products.
- Automobile Manufacturers: Marketing objectives include brand building, loyalty promotion, and heritage preservation.
- Insurers: Verifying vehicle authenticity is crucial for asset and individual protection.
- Entertainment: Immersive experiences through augmented and virtual reality, as well as skill games.
- Law Enforcement: Assistance in identifying vehicles involved in investigations.
- Vehicle Designers: Access to historical automotive designers work and perspectives for new design development.
- Travel: Roadside support, fuel, lodging, food, interesting roads and points of interest.
- Classic Car Market, Auto Parts, and Collectors:** Buyers, sellers, and restorers require parts authenticity, provenance information, pricing, and historical context.
- Museums and Archives: Assistance with vehicle identification, provenance, and automotive history retrieval from their photo collections.

The Value Proposition: This innovation serves both societal and business objectives. Cultural knowledge about one of humanity's most significant inventions, the automobile, is fragmented and inaccessible. The proposed system enables users to identify automobiles while simultaneously building provenance and preserving knowledge about vehicles and our cultural heritage.

Users can access curated information about automobiles and roadside heritage through a virtual library that integrates other datasets to form a central, integrated intelligence platform about automobiles and car culture.

Transportation designers can easily access lessons learned from the past 140 years of automotive design.

Key Differentiator: The Automobilia dataset, curated over many decades, contains thousands of assets and verifies provenance through timely copyright registrations at the Library of Congress, ensuring the authenticity of automobiles and their cultural impact. The data set includes media assets capturing time, place, historical context, and significant background architecture.

Innovation: Deep Learning-based object computing semantic platform enables training of a neural network identifying automobiles from 1885 to the present. This innovation provides curated knowledge and answers “What is It?” specifically in the automotive vertical market through expert identification and object computing.

Instantly and accurately identify automobiles, accumulating social data around vehicles and establishing provenance for cars and their cultural impact, which society has lacked easy knowledge and authentication about.

COMMERCIAL OPPORTUNITY

The Commercial Opportunity

The NameThatCar market addresses two key needs: the audience seeking automotive information and knowledge, and the advertising industry seeking authenticated users for targeting purposes. With the $45B U.S. automotive advertising market poised to grow, NameThatCar can provide the solution.

2022 U.S. Automotive Advertising in Million US $

Market Sector	Spending $B
Volkswagen Auto Advertising	855
Hyundai Auto Advertising	690
Nissan Auto Advertising	1,090
Honda Auto Advertising	1,530
Fiat Chrysler Auto Advertising	2,260
Toyota Auto Advertising	1,660
Ford Auto Advertising	2509
GM Auto Advertising	3,250
Auto Advertising - TV	4,733
Auto Advertising - Measured Media	16,861
Auto Advertising - Rental & Leasing	504
Auto Advertising - Dealers & Gas Stations	4,380
Auto Advertising - Digital	4,812
TOTAL 2022 Auto Advertising in US $ Million	**45,134**

COMMERCIAL NEED - BRAND ADVERTISING

The automotive advertising market opportunity is vast, but unauthenticated social media posts, EU law changes, and the replacement of “cookies” in advertising systems make identifying potential targets challenging. Advertisers need a better way to target Brand Advertising. In 2019, total Auto Advertising spending reached $45,134 billion.

The NameThatCar system will help the brand advertising segment. Users can self-identify their brand advertising interests using the app, allowing advertisers to target customers with relevant products and services.

SOCIETAL NEEDS

PRESERVATION OF KNOWLEDGE - In the 21st century, a user may encounter an automobile on the street and wonder what it is and how much it is worth. This information is currently unauthenticated, fragmented,

dispersed, and not readily available in searchable form, etc. This innovation provides a system for the preservation and accessibility of collated/correlated/curated historical information—media and text—about and concerning automobiles, their use in our society, the environments in which they were used (racing and street), how they were used, jobs they created (in manufacture & maintenance, consumer uses, collectors, etc), technical/design features and special relationships with society, etc.

As society digitizes, augmenting human intelligence with artificial intelligence can answer questions with curated knowledge—AI has always been about making things possible.[1] The essence of being human, is to ask questions[2] and the NameThatCar platform seeks to provide credible information about a technological evolution: the journey of the automobile, as well as the remaining surrounding artifacts of our automotive heritage populating culture today.

PERSONALIZED ROADSIDE SERVICES

With the growing availability of geo-location data, and the belief that curation of photos around architectural cultural heritage sites will multiply in this AI platform, there will be an opportunity to direct users attention to roadside services based upon the personalized User data. For instance, suppose you drive a sports car, known by information in your NameThatCar profile. Your next appointment may not be for another hour, your current navigation program estimates arrival in 15 minutes, but there is a great two-lane road you could drive that would be fun and put you at your destination on time.

CULTURAL HERITAGE

Families throughout the 20th and 21st century authenticate life in photographs, often taken on car vacations criss-crossing America. This data could be surfaced and used to virtually augment cultural heritage sites or Historic Places with photos and stories from by-gone eras including the automobiles that transported them. Recreating Route 66 tourism will be virtually possible, enabling a kind of time-travel.

AUGMENTED REALITY

Augmented reality (AR) is becoming more popular in cultural heritage tourism sites, making the tourist experience even better. By connecting the information in family photos to the history of those places, we could create a real AR system for America's Historic Places. Our first customer might be an auto club like AAA. You could point your phone at a car or a historical site and watch as time unfolds, revealing changes to roadside America based on your location. Since people interact with cars so much, this AI-powered product will be unique and a global heritage portal.

MARKET AND ADDRESSABLE MARKET

The market is fragmented and incoherent, with information gathered by each segment without a relationship, making it difficult to search.

We have a two-sided market: users seeking information and customers advertising. Each market segment has its needs and value proposition. **Users** upload unidentified photos and review vehicle brand archives,

indicating their interest in specific brands or segments for advertising. Reading Porsche archives targets Porsche advertising.

While the overall market is fragmented, the 2022 automotive advertising segment alone exceeded $45 billion, excluding travel, food, and automotive repair. The automotive advertising sector is the second largest in the overall advertising marketplace. We'll target this market first in commercializing NameThatCar.

Our largest **customers** are advertisers: new car buyers interested in automotive heritage, collectible car enthusiasts, automotive parts, insurance, travel, archives, libraries with unidentified assets, and consumers with unidentified photo albums of family vehicles. Government, security, law enforcement, and the entertainment industry also have commercial opportunities.

The total addressable U.S. market for this application is the global automotive market.

HOW HAS THE MARKET OPPORTUNITY BEEN VALIDATED?

After speaking with insurance heads, auctioneers, parts manufacturers, handset manufacturers, advertisers, and OEMs, it's clear that all auto advertisers need the ability to target their automotive advertising digital spend. Customers exist but need better service than search engines can provide due to a lack of experts and curated content around collective intelligence.

Identification: Other platforms that use collective intelligence are analogous to our project. Shazam Entertainment and Waze are the closest validations of NameThatCar's market opportunity. Privately held Ancestry.com shares relevant features but has few financial reporting records.

Shazam identifies recorded music clips with song title, lyrics, and performing musicians. Apple acquired Shazam for $400 million to boost iTunes music sales. Shazam's revenues came from in-app advertising, referring buyers to purchases from 99-cent songs to ancillary products like alcohol and technology. NameThatCar's first advertising model could be replicated from Shazam by referring buyers to cars sold at a higher price point.

Community Curation: Waze Ltd. developed a customer-based data aggregation service to help customers and government solve ground navigation problems. Acquired by Google for over $1 billion, Waze advertising increases vehicle business service and sales by delivering relevant contextual ads to drivers on highways.

COMPETITION

Google and other search engines can only infer car makes, models, and years from unauthenticated data, making it difficult for users to authenticate cars on the platform. Users looking to authenticate an automobile on Google can spend hours and still be uncertain of the exact make – model – year. Automobiles are a significant portion of the internet search engine market, and search engines lack a verifiable source of automotive lore and the authority to identify cars. NameThatCar aims to solve this problem by verifying the provenance of cars.

KEY RISKS

Two major threats to market launch are developing a semantically-linked AI identification model (R&D) and building a strategic partner alliance for faster time-to-market. Talks are underway for a strategic alliance to build a complete industry solution. Plans include forming an expert community group after demonstrating an MVP. The application seeks to solve new computational challenges with authenticated and verifiable data in a phase 2 project as standards develop.

COMMERCIALIZATION

Identifying targeted customers is the market driver plaguing many industries in advertising. This platform will solve the missing link of brand-driven advertising targeting interested consumers. To become a **destination tool**, it must address advertisers' marketing problems and answer the question "What is this car?" an AI tool for vehicle identification is needed.

Revenue potential is difficult due to the limited number of AI products. NameThatCar offers a unique mix of display, visual, audio, and location-based technologies to discover cultural artifacts. Emotion and engagement are potent drivers of brand advertising, and these partners will be actively courted to scale and launch successfully.

RESOURCES NEEDED TO IMPLEMENT COMMERCIALIZATION APPROACH

Audience participation is crucial for implementing the platform's commercialization. Car clubs and internet search engines are primary avenues to reach the audience.

Strategic partnerships with complementary products are needed for mainstream customer growth and additional expertise after the MVP is built.

Automotive brand partnerships are possible if phase 1 of the application development proves feasible. A demonstration of our capabilities can be leveraged to partner with brand advertisers.

The following commercial research is considered confidential and should not be disclosed:

Ironically, the search engines that have decimated intellectual property now provide a key to his new opportunity. Recent changes in EU law, the demise of cookies, the rise of object-oriented computing, and Digital Object Identifier (DOI) registries have brought about a seismic shift in the Advertising and Marketing marketplace.

In response to EU legislation, Google Images announced in late 2018 that it would begin publishing certain embedded metadata fields, including Creator, Credit, and Copyright, when returning image search results. To comply with copyright recognition at scale, Google will read embedded Registry data, an identifier field containing DOIs. Since Automobilia is the copyright owner for the ML model and semantic dataset proposed in this initiative, whenever a published image is indexed by Google, it will link to the Automobilia registry and directly into this platform, accelerating growth and adoption.

PLAN AND TIMELINE

Train a neural network with the Automobilia multi-class semantic dataset using supervised learning models, enthrall users, curate cultural heritage and embrace brand advertisers. One year.

THE INNOVATION

The Innovation

NameThatCar, an expert system, uses machine learning algorithms trained on a proprietary dataset of curated photos, videos, and data to identify automobiles from 1885 to the present day. Users can annotate cars by sharing their stories and comments.

This invention is unique and magical. It's like a time machine chassis capturing alchemical memories of shaped metal propelled through time and space by the thoughts of engineers. The neural network is trained on a trans-disciplinary dataset that represents abstract concepts like emotions, language, space, logic, art, and society using semantic keywords. For instance, "Art-Deco" is a semantic artistic keyword found on many vehicles from the 1920s and 1930s due to their visual design language.

Deep Learning is used to repeatedly train the neural network for each distinct feature hierarchy, resulting in object recognition enhanced by semantic intelligence and linking back to society.

Here we have an opportunity to build a multi -faceted time capsule around one of the greatest achievements of mankind, the invention and development of the automobile. Additional databases, like engineering info, racing results, car shows, and valuations can be layered on this primary innovation. Users can browse Chevrolet Corvettes, read or listen to automobile entries, and experience the development of streamlining or the condensed automotive design language of a decade, like the Fifties.

Shazam, Waze, and Ancestry.com combined. Hold up your mobile device to an interesting car to learn its story through interaction with NameThatCar. Did you know the straight-eight engine was invented a century ago? The platform will recognize and identify automobiles via voice, image, and text, and record users' personal stories about automobiles' significance in American history. Families can upload family photos to learn about their ancestors' automobiles. What was grandfather driving in this family album?

Visit a Historic Place site and view hundreds of automobiles and families that visited the same site over decades. Layer family vacation photos with a geo-location to create a virtual timeless environment. The innovation can pave the way for an immersive AR environment where you, your ancestors, and their automobiles are at the same cultural heritage site, evoking a ghostly rapture within time and space. How many photographs with the family car were taken at Golden Gate Bridge over decades?

The AI in this innovation solves a fundamental problem in advertising: authenticating users' interest in automotive brands, models, or types. By uploading an unidentified Alfa Romeo, users self-identify their interest. Repeated interactions with sports cars teach the platform their interest in this vehicle type. This feedback loop benefits advertisers for better targeting and provides intelligence to manufacturers of future automobiles. Direct-to-consumer marketing will increase.

The ancient Greek historian Herodotus (c. 484 - c. 425 BC) dedicated his life to preserving historic truth, preventing the erasure of human events by time. He remains the leading source of information on the Greco-Persian wars and much of western Asian and Egyptian history. During his struggle, he faced the dilemma of recounting history from second-hand truths, as reported by observers of actual events.

In this application, we have first-hand history, authenticated through timely registrations at the Library of Congress Copyright Office, preserved in the ML training dataset, and a system for users to add second-hand annotations about their car culture relationships.

Human-computer interaction will be encouraged because the application will ask users to provide feedback on the automobile in the identified returned photo, comment on their memories, submit family photos, record, preserve, and link automobile relationships to communities, architecture, engineering, history, government, and culture to disseminate car culture knowledge. If an unknown car or significant automotive cultural heritage artifact is found, the application will use crowd wisdom to identify and classify it. History will come alive.

NLP enables the AI agent to develop chat interactions with users about automobiles and immersive environments in media, deepening human-computer interaction skills. This is an unusual and transformative development of artificial intelligence, an early stage application that can evolve into an AR application with sustained AI Chat capabilities in future iterations.

TECHNICAL CHALLENGES

The problem of fine-grained image classification is still far from solved despite the wide spread use of artificial intelligence platforms. We plan on levering deep learning techniques to link verified semantic data (make-mode-year) to visual tokens extracted through ML representing automotive training images. Running ML training with our trained visual tokens allows us to model relationships between background features found in images and drastically improves results and time.[3]

Identifying Cars. While we might not initially have enough photos of a particular make-model-year of automobile, we can learn through this research how to map the semantic dataset to the functions and token extracted through building a neural network. This is one of the key challenges of the phase 1 application.

The last challenge will be laying the groundwork for human-computer interaction capable of sustaining a chat about automobiles, anticipated in a phase 2 project. In many human lives of the twentieth and twenty-first century, automobiles are key family members and have played a part in ferrying families from birth to death, on wedding trips, to and from school, work, and on vacations. Talking about it is fun.

RISKS

The future of AI is fraught with uncertainty which the recent appearance of Deep Fakes and development of Adversarial Examples designed to fool classification systems has made apparent. [4] Key to offsetting these events is to authenticate Primary Sources of data. Stated another way, rely upon human intelligence residing in the underlying database and not upon hyper-parameters for determining provenance. Secondary sources of information should be weighted accordingly, but should be aggressively captured now as future data sources. Humans will verify the final neural model.

This proposed ML matrix is built upon primary historical sources which must be securitized in the digital realm. Securitizing the data includes authenticating primary sources and upon rapidly unfolding developments in digital object computing and serverless technology. Supervised learning modules can be incredibly powerful for human augmentation, but staying ahead of the machine means developing in tandem with technology. There will be a creative leap by the time phase two is ready.

INTELLECTUAL PROPERTY

All Media, Text and Database is confidential to Automobilia and registered at the Library of Congress Copyright Office. TXu002406113 / 2024-01-05

PCT Patent Application- WO 2020/227651 A1

THE COMPANY/TEAM

Automobilia II, LLC is an Intellectual Property holding company founded by Lucinda Lewis. Assets include over 500,000 media assets, library, letters, eight book manuscripts, data, property releases, car show programs, model releases, copyright registrations and a database centered on the evolution of the automobile from 1885 through the present day. This is a life's work of Lucinda Lewis built over multiple decades. The MVP neural architecture will accommodate other car enthusiast's authenticated work too.

The idea for creating the research project with NameThatCar through Automobilia II originated over frustration with the difficulty in credibly authenticating significant vehicles both through the internet and often even with their owners. An opportunity arose with recent changes in the EU law that are creating a legal need for photo and video attribution and a requirement for copyright notice preservation on internet search engines. Previously, all embedded metadata was stripped from media assets upon upload to the internet. For this reason, Automobilia II's assets have been largely unpublished for many decades.

A team of highly-qualified technologists and Data Scientists, is being assembled in conjunction with our research partner, SupportVectors. Our research goals are driven by the need to:

- Instantly and properly identify automobiles by training artificial intelligence tools
- Preserve our cultural history and promote our Historic Places influenced by the automobile's evolution through seeking strategic relationships with non-profits
- Establish automotive provenance based off first-hand historical records
- Celebrate and educate around the invention of the automobile, learn from its history and help shape mobility's evolution
- Explore human-computer interactions
- An addressable automotive advertising market currently spending $ 38 trillion U.S. dollars

• Technologically sophisticated automotive start-up CEO with experience in all phases of development for marketplace services and relationships within the automotive world.

• Data Scientists at SupportVectors who wish to train on trans-disciplinary curated data

Automobilia II is ideally positioned to build an automotive AI identification and authentication platform designed to inform and delight users about deeper contextual elements surrounding the role automobiles play in our lives.

LUCINDA LEWIS
PRINCIPAL INVESTIGATOR AND SUBJECT MATTER EXPERT
FOUNDER: AUTOMOBILIA II, LLC

The creation and cataloging of data surrounding the automobile is a life-long obsession for Lucinda Lewis, Principal Investigator. The founder of two companies, Lewis will devote her time and considerable subject matter expertise to the proposal. Lewis is a life-long automotive historian, photographer, filmmaker, author and technologist with experience on seminal World Wide Web (W3C) initiatives, including the Automotive and Web Platform Business Group, which created the backbone of the Autonomous Driving API that exists today. Additionally, her work on the Open Digital Rights Language (ODRL) strengthened her belief in semantic web technologies and their power to enhance human knowledge through digital distribution and rights expression into multiple languages.

Raised as an aviator in the mountains of West Virginia, Lewis sees the digital landscape at a high altitude. The neural imprint gained from learning navigation skills as a child, shaped Automobilia II's database development which easily maps to today's artificial intelligence machine learning algorithms and opportunities. Upon graduation from university, Lewis's family was dismayed when she turned down law school for her newly discovered love of photography. A promise to her father, an attorney, to register all her copyrights and a pact with her grandmother, a library lover, to catalog all her work kept the family peace and resulted in the Automobilia II database—an amalgamation of Lewis's love of art, automobiles, history, media, libraries, technology, and strategy. In 2010, realizing there was a need to fix the media distribution supply chain, she returned to school to earn her MBA and became interested in fitting semantic technologies to her database.

ASIF QAMAR, PHD THEORETICAL PHYSICS
MASTERS IN COMPUTER SCIENCE AND THEORETICAL PHYSICS
CTO - AS SUBAWARDEE AT SUPPORT VECTORS, INC.

Asif Qamar's career has spanned two parallel tracks: as a technical architect, and a passionate educator. While Asif primarily spends his time technically leading research and development efforts, he finds expression for his love of teaching in the workshops he offers at SupportVectors research lab. Through this, he aims to mentor and cultivate the next generation of great technical craftspeople.

As an educator, Asif has taught various subjects in Programming, Machine-Learning and Physics for the last 25 years.He has taught at the University of California, Berkeley extension, at the University of Illinois, Urbana-Champaign (UIUC), and Syracuse University. Besides this, he has given a large number of workshops, seminars and talks at technical workplaces. He has been honored with various excellence in teaching awards, in the universities and technical workplaces. Asif has published numerous research papers and has two patents.

SupportVectors, Big Data - AI Research Lab is unique in the deep integration of research and education in the field of Machine Learning and Big Data.

TECHNICAL DISCUSSION AND R&D PLAN

Cultural Heritage Images and Narratives in a hybridized neural training and inference

A novel neural architecture pipeline is described here that creates a hybridization of the Visual Transformers for image-classification and segmentation with the NLP-based transformers for textual data. The central goal is the preservation and accumulation of a key area of historical and cultural interest; this poses a unique technical challenge since the domain of applicability refers to heritage cars over historical periods of time. As such, commonly available datasets are not applicable.

Instead we have a unique repository of very high resolution professional photographs derived from decades of effort, along with historical narratives about them. The expected conversations and submitted images will grow around this repository in a unified manner. Therefore, one has to come up with a notion of vocabulary where we need an atomic-unit of representation learning that incorporates both elements of convolutional filters derived primitives and visual tokens from visual transformers, as well as NLP based linguistic tokens. We intend to create this unification by hybridizing attention-based transformer models in NLP with convolutional filters as well as the visual-transformers. ***To our knowledge, this approach has never been tried before, perhaps because this particular problem is somewhat unique. Also, it needs rather painstaking annotation of rare visual artifacts with their histories, to generate the needed dataset.***

To illustrate a common task the AI pipeline needs to handle at inference time : **Jointly** identify all the cars and associated cultural heritage objects (including any historical places) from an image, as well as generate the most appropriate narrative. The converse of this too – the identification of the best cultural objects, and automobiles that form the context of a broad descriptive narrative represents an innovative mapping from the natural-language processing domain of AI to multi-label image classification and segmentation. But, more interestingly, given only partial visual perspectives on a car where under certain aspects such as taillights are present, and textual narrative of its history, we need to be able to both identify and reconstruct the complete car image, and generate its historical annotation that incorporates the input textual narrative.

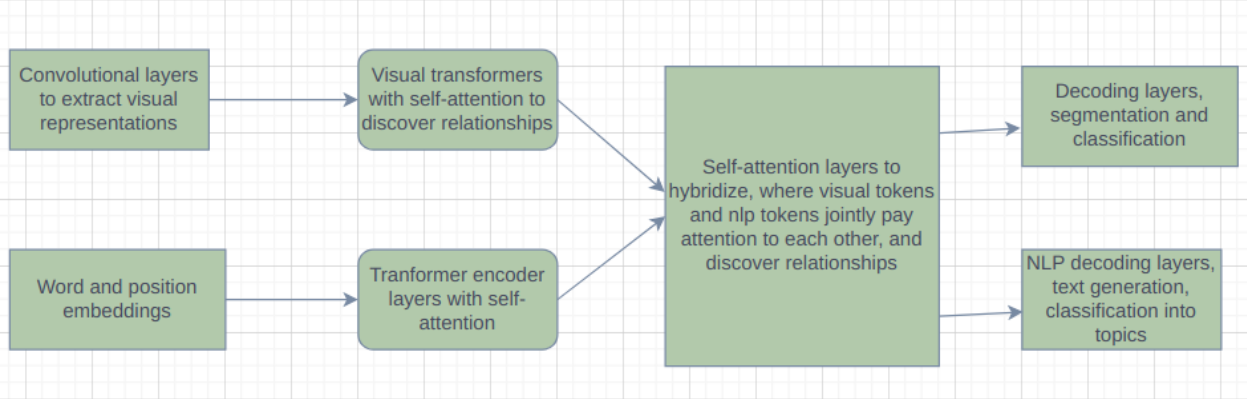
Figure 1: A representative image with AI-driven annotation and augmentation with cultural history. Five separate cars have been individually identified and annotated. Also, the driven-in sign is identified. Importantly, the contextually relevant history from the corpus has been summarized with natural language processing.

Until recently, deep-learning applied to image processing was dominated with convolutional neural-nets where earlier layers extracted basic geometric primitives and the later layers composed them into higher-order representations; the application of deep-learning to NLP, on the other hand, was dominated with attention-based transformer models sometimes hybridized with RNN/LSTM/GRU. Two recent breakthroughs, however, give us the starting point to develop our unified treatment that hybridizes text and images into a common AI architecture. First is the recent emergence of visual transformers[5] and their effective use[6] which

help create, in essence, words or visual tokens that start out by being pixel-regions, and later, higher-order extractions from them; for one thing, they address the spatial relationship aspects which CNN did not handle well. More specifically, emerging research shows that one can successfully use earlier layers of convolutional to extract higher-order representations, followed with visual transformers where the extracted “tokens” learn spatial relationships and relevances through the self-attention mechanism.

Neural Architecture

In our neural architecture, we intend to pass the image-parts through the earlier convolutional layers to extract the visual tokens; and the textual parts through the encoder-layers of the transformer. Hybridizing the two with self-attention so that we get joint encoded representation of the complete visual and textual context, as well as inter-token attentions between visual and textual tokens. This we intend to feed into decoder attention layers trained to simultaneously identify the car or its attributes, and/or other historical objects, along with any relevant textual narrative associated with the extracted object in our database.



Since there are a large number of ways to construct this hybrid neural architecture, we intend to exploit automated-ML, neural architecture search to assist in the design of the optimal architecture.

This could be a daunting computation for training the model; however, there has been a slew of recent breakthroughs bringing significant speedups of the transformer training. In particular, use of the Performers[7] remove the quadratic computational bottleneck.

A collaborative user verification process will improve the accuracy of the image-augmentation by pointing out errors and corrections. In other words, should certain annotations turn out erroneous and the users mark it as such, that will feed into the next round of neural architecture training.

Application Architecture

While the core of the project will comprise an interesting neural architecture and data-training pipeline, the rest of the project will remain the contemporary cloud-based, microservices-driven architecture comprising of the expected:

AI Models At the core of the project are the trained AI models that classify and identify photos. These will be kept and managed by the training and deployment pipeline.

Persistence The storage or persistence layer, that will store the photos, the metadata as a multidimensional cube warehouse, the AI- models, the textual narratives, the search-indexes, as well as the application underlying transactional database.

Containerized Microservices The runtime logic execution layer will comprise of a collection of docker-container based microservices exposing REST APIs. These will be orchestrated through Kubernetes[8].

Web Presentation React.js[9] presentation layer for rendering the web-presentation layer in HTML5/CSS.

Key Milestones and Performance Indicators

Since cultural narratives augmentation of car images forms the crux of the project, the key performance indicators would pertain to the quality of augmentation. In the process of doing a proof-of- concept implementation of the project, the crucial milestones are laid along two parallel tracks:

AI Modeling Milestones : This parallel track of milestones are associated with building each of the AI models and training them for sufficient accuracy and performance

CloudArchitectureMilestones: These are milestones associated with creating the software framework to support the main engagement of the user with the machine-learning models

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AI Modeling Milestones

The main milestones of the effort track for building, training and validating the AI neural models are depicted below.

5-Month Milestone: All heritage object annotation complete This will also include training the CNN and visual transformers to extract significant "keyword" visual elements.

7-Month Milestone: Joint Visual and NLP training Addition of narrative/NLP elements to the neural architecture, and joint-training of the model

9-Month Milestone: Go to Production A fully deployed AI inference pipeline in production, integrated into the application

12-Month Milestone: Improve model performance to the level of KPI goals

The key performance indicators for the neural architecture are as follows:

Accuracy, Precision and Recall of the image classification: We hope to achieve greater than 90% accuracy in the multi-label classifier of heritage artifacts, as well as the associated textual narratives.

Evaluation of the Narrative Generation Ensure that greater than 80% of relevant keywords and artifact associated concepts are included in the narrative summarization of the textual elements identified as relevant.

*User-Validation of AI-derived summaries: T*he project aims to achieve annotation with relevant cultural summaries that would have accuracies of greater than 80% in the first phase, and more in the final project.

Car-clusters from broad descriptions: When the user provides a verbal broad description, or some fragment of a visual elements, the project aims to achieve a greater than 90% top-3 accuracy in identifying or recognizing the heritage car being described, where the text is sufficiently descriptive and returning an image.

Cloud Architecture Milestones

2-Month Milestone: Web UI Complete Web UI with interactions

4-MonthMilestone: Persistence All database designs and persistence code fully completed; database loaded with data and operational

7-Month Milestone: Microservices All microservices developed and tested to engage underlying AI models

9-Month Milestone: The entire application engaging users with AI models delivered

Since we will be pursuing an Agile-development methodology for the software architecture aspects, the milestones adhere more closely to each of the independent areas of work, and are depicted above. The performance or robustness metrics to pursue as KPI are as follows:

Latency Metrics : When a user uploads a picture, the project aims to be able to analyze it and augment it with narrative annotation within 120 seconds of the upload.

Uptime and Availability Metrics: After phase 1, the front-end web application that engages the project neural models should have at least a 99.9% uptime

Scalability: The phase 1 aims to provide a scalability of up to 100 concurrent users, assuming standard think-time, engaged with the neural models through the project's web-application

Completeness: The web-application exposing the neural models must provide functionality in each of the areas mentioned in the previous paragraphs. In other words, the users should be able to upload photos for cultural augmentation, as well as search for images based on memories and narratives.

Persistence

Stored as object-storage in Google Cloud Platform (GCP)[10], this is the repository of the high-resolution photographs of automobiles and relevant history taken over the years.

Stored as Google BigQuery[11] storage in GCP to conceptually express it as a multidimensional cube/data-warehouse, this is the metadata comprising of the background information on each of the photos.

The narratives, histories and discussions of the use-base will be stored in ElasticSearch[12], a scalable search index database.

The underlying database containing the main NameThatCar application artifacts will be stored in Google Cloud SQL[13] as a managed MySql database, in order to ensure ACID transactions.

REFERENCES CITED

[1] https://www.nytimes.com/2000/12/28/technology/still-a-long-way-from-checkmate.html

[2] Markoff, J, " A Fight to Win the Future: Computers vs. Humans." The New York Times 14 Feb. 2011, / science/15essay.html.

[3] Visual Transformers/ Token-based ImageRepresentation and Processing for Computer Vision https://deepai.org/publication/visual-transformers-token-based-image-representation-and-processing-for-computer-vision

[4] Mitchell, Melanie Artificial Intelligence: A Guide for Thinking Humans, Farrar, Strauss, Giroux, 2019

[5] Alexey Alexander Kolesnikov, Dirk Weissenborn, Xiaohua Zhai, Thomas Unterthiner, Mostafa Dehghani, Matthias Minderer, Georg Heigold, Sylvain Gelly, Jakob Uszkoreit, and Neil Houlsby. An image is worth 16x16 words: Transformers for image recognition at scale. 2020

[6] Bichen Wu, Chenfeng Xu, Xiaoliang Dai, Alvin Wan, Peizhao Zhang, Zhicheng Yan, Masayoshi Tomizuka, Joseph Gonzalez, Kurt Keutzer, and Peter Vajda. Visual transformers: Token-based image representation and processing for computer vision. 2020

[7] Krzysztof Choromanski, Valerii Likhosherstov, David Dohan, Xingyou Song, Andreea Gane, Tamas Sarlos, Peter Hawkins, Jared Davis, Afroz Mohiuddin, Lukasz Kaiser, David Belanger, Lucy Colwell, and Adrian Weller. Rethinking attention with performers. 2020

[8] Kubernetes. https://kubernetes.io

[9] React.js. https://reactjs.org

[10] Google cloud storage. https://cloud. google.com/storage/ Google Cloud Storage provides a cost-efficient, high-performance storage suitable to these assets, each accessible through its own url

[11] Bigquery: Cloud data warehouse. https://cloud.google.com/bigquery/, Example dimensions for querying are: year of make, manufacturer, model, etc.

[12] Elasticsearch. https://www.elastic.co

[13] Google cloud sql. https://cloud. google.com/sql