



Partnering with Retail Customers

CV for Retail

Date: 01-SEP-2024

Agenda

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O4 Select Use Cases - Retail CV



Tiger Analytics Overview

Who Are We?

We're passionate about solving some of the toughest business problems out there using AI and analytics.

Our Focus

Providing certainty for a better tomorrow.



Fastest Growing Services Provider of Data, Technology and Analytics Solutions





5,000+

Data & Al Professionals



75+

Fortune 1,000 Clients across Industries



80%

Revenue is repeat business from existing clients



~10%

Attrition rate & highly engaged team

Key Recognitions



Wave Leader in Customer Analytics Service Providers **2023**



Leader and Rising Star in Data Science and Engineering **2023**, **2022**



Leader and Star Performer - Analytics and Al Services PEAK Matrix® 2024, 2022



America's fastest growing companies **2023**, **2022**, **2021**



A minority-ownedenterprise certified by USPAACC



India's Great Place to Work **2023**, **2022**



America's fastest growing companies **2023**, **2022**, **2021**



Best Workplaces for Women in India 2023



AIM's Top GenAl Service Providers 2023



Brandon Hall Award -Learning and Development **2023**



Deloitte Technology Fast 50 India 2023



AWS Partnership & Relevant Engagements





- Global Advanced Tier Services
 Partner
- Global ProServe MSA
- Machine Learning Competency
- CPG Competency
- SDP EMR specialization
- SDP Redshift specialization
- SDP Glue specialization
- SDP Quicksight Specialization
- SDP Lambda Specialization



- 170+ AWS Certifications
- AWS Certified Associate, Professional
 & Specialty Level
- 35+ Strategic engagements globally



Innovations

- Content Ingestion Solution
- AWS Data Fabric
- Data Quality & Profiling Framework
- DataHub Metadata platform
- Automating laaC using Terraform
- MLCore
- Tiger Data Observability Solution



aws

PARTNER

Global Manufacturer

aws

PARTNER

Assisted in creating an end-to-end Data Platform in order to implement a solution for predicting maintenance of assets.



Healthcare Provider

Built robust Data and Analytics (D&A) platform that can act as an Enterprise Data Hub to host structured, semi structured and unstructured data and support various analytics and reporting.



Retailer

Developed a scientific approach to measure and analyze the impact of various marketing activities on Sales, to support Marketing spend decisions for the financial year.

Our Capabilities

Data/ML Engineering



- Data Pipelines
- Agile Data Ops
- Platform Engineering
- Future State Architecture

- Cloud Data Lake
- Modern Data Platforms
- Cloud Data Migration
- Lean Data Governance



Tiger's Data Fabric helps cut-down the time it takes for setting up new Data Pipelines in Cloud from days & weeks to few minutes

Related Offering Examples

Al and Data Science



- Machine Learning
- Predictive Analytics
- Statistical Modeling
- Optimization Methods
- Streaming Analytics

- Generative Al
- Computer Vision
- Natural Language Processing
- Reinforcement Learning
- Deep Learning



Our **CV Framework** leveraging state of the art algorithms helped a Fortune 50 company with in-store shelf intelligence, stock-outs, footfall, SKU rotation

ML Engineering and Consumption



- ML Operationalization
- Scaling AI/ML solutions
- AI/ML Application Engineering
- APIfication

- Business Insights
- Analytics Story Telling
- Visual Analytics
- Value Realization



ML Core, a low code ML Platform with ready to use data models, features, ML models, dashboards streamlined production operations for a PE firm

Supplemented with a wide array of Reusable Tools, Methodologies and Frameworks

Consulting



Design Accelerators



AI/Data Science/Insights



MLE & MLOps



Industry Solutions



Data Engineering



Metrics Repository

Prominent Use Cases

Business Hypothesis

Analytical Questions

Value Articulation Framework

Analytical Techniques

Simulator 360

Design Templates

Design Artboards

Design Tool
Standardization Process

Tiger ML Functional toolkits

Code Templates

Codified NLP libraries & pre-trained modules

Codified CV libraries & pre-trained modules

Convo (Context-Need-Vision-Outcome) Discovery & Design Framework MLCORE Platform

MLOPs best practices

Monitoring and Governance framework

Marketing Mix Modelling

Emerging Trends
Solution

Demand Forecasting Solution

Test & Learn Platform

Omnichannel Attribution Solution

Supply Chain Analytics Solution

TPO Platform

Data Enrichment Catalog

Data Fabric

Observability Framework

Data Ingestion framework

Data Quality framework

Data Assessment framework

102 Tiger CV Capabilities

CV Practice Overview



CV Expertise 100+

Data scientists experienced at solving complex CV based problems

Dedicated CV R&D Lab



Client Projects

30+

Developed and successfully productized



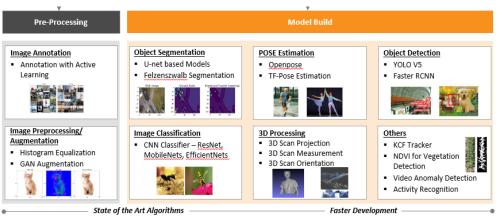
Vision Language (Gen AI) 5+

Live POC'S on CV-Gen AI use cases

Dedicated research on Gen AI -CV

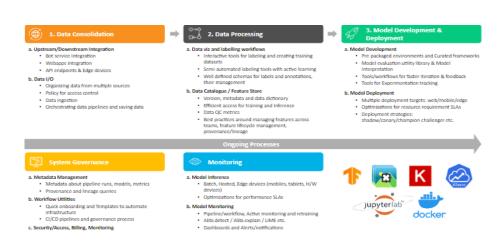
Tiger's Computer vision accelerator

Component libraries developed and evaluated on public datasets in usable format for training/inference



CV Framework for Video and Image Analytics

Comprehensive framework to build and deploy complex CV use cases



DE & Cloud Experience

- Preferred partnership with Cloud providers
- Proficient in GPU computing, model deployment, real-time inference and other related areas that allow us deploy our solutions on any cloud platform
- 900+ Data Engineers, Solution and Data Architects

MLOps Experience

- CI/CD pipelines to automate build, test & deployment of models into production
- Automation of pipeline workflows (data, training) and infraprovisioning
- Model monitoring framework (Model, Data drift) with automated retraining trigger

Tiger's Computer Vision Accelerator Components

Component libraries developed and evaluated on public datasets in usable format for training/inference with new data which provide us access to labelled images and pretrained modules

Pre-Processing

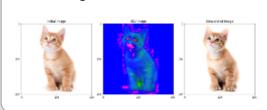
Image Annotation

Annotation with Active Learning



Image Preprocessing/ Augmentation

- Histogram Equalization
- GAN Augmentation



Object Segmentation

- U-net based Models
- Felzenszwalb Segmentation

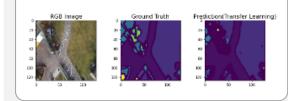


Image Classification

 CNN Classifier – ResNet, MobileNets, EfficientNets





POSE Estimation

- Openpose
- TF-Pose Estimation



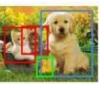


Model Build

Object Detection

- YOLO V5
- Faster RCNN





3D Processing

- 3D Scan Projection
- 3D Scan Measurement
- 3D Scan Orientation





Others

- KCF Tracker
- NDVI for Vegetation Detection
- Video Anomaly Detection
- Activity Recognition



Our Framework for Video and Image Analytics



1. Data Consolidation



- Bot service Integration
- Webapps integration
- API endpoints & Edge devices

b. Data I/O

- Organizing data from multiple sources
- · Policy for access control
- Data ingestion
- · Orchestrating data pipelines and saving data



2. Data Processing

a. Data viz and labelling workflows

- Interactive tools for labeling and creating training datasets
- Semi-automated labeling tools with active learning
- Well defined schemas for labels and annotations, their management

b. Data Catalogue / Feature Store

- · Version, metadata and data dictionary
- Efficient access for training and inference
- Data QC metrics
- Best practices around managing features across teams, feature lifecycle management, provenance/lineage



3. Model Development & Deployment

a. Model Development

- Pre-packaged environments and Curated frameworks
- Model evaluation utility library & Model Interpretation
- Tools/workflows for faster iteration & feedback
- Tools for Experimentation tracking

b. Model Deployment

- Multiple deployment targets: web/mobile/edge
- Optimizations for resource requirement SLAs
- Deployment strategies: shadow/canary/championchallenger etc.

Ongoing Processes



System Governance

a. Metadata Management

- Metadata about pipeline runs, models, metrics
- Provenance and lineage queries

b. Workflow Utilities

- Quick onboarding and Templates to automate infrastructure
- CI/CD pipelines and governance process

c. Security/Access, Billing, Monitoring



Monitoring

a. Model Inference

- Batch, Hosted, Edge devices (mobiles, tablets, H/W devices)
- Optimizations for performance SLAs

b. Model Monitoring

- Pipeline/workflow, Active monitoring and retraining
- Alibi.detect / Alibi.explain / LIME etc.
- Dashboards and Alerts/notifications











03 CV for Retail

Solution Approach

Requirement Gathering

- Collaborate with business teams to identify the scope & granularity of key use cases
- Define key metrics associated with each use case
- Collect the input video data from CCTV cameras for preprocessing and analysis

Data Pre-Processing

File Decoding

Convert encoded video files to mp4 format and prepare them for modeling

- Frame Extraction
- · Zone definition
- Noise Reduction
- Image Enhancement
- Normalization

Model Development

Custom model development for each use case:



Assisted Checkout Identification Engaged vs Non-Engaged Checkout



Traffic Pattern MappingAisles of Interest



Idle Time Spent in officeManagers Office Activity Analysis



Stockroom Freight Dwell TimeNo. Hours pallet remains unopened



Transaction Oversight at Point of Sale
Prevent fraudulent returns



Planogram complianceRight placement of products in shelves to maximize sales

Model Techniques

- Yolov8 & BoT-SORT models to detect and track people in the frame
- Multi-Person tracking to differentiate between employees and customers
- Re-identification of individuals across non-overlapping camera views using models like DeepReID & Fast ReID
- Yolo-Pose v8 for key point detection





Refine models with additional client data





Metrics Computation

Output

Model Results

Output data for each use case; Annotated videos with bounding boxes





Dashboards for Visualization

Web based user interface for easy access to monitor metrics across different use cases

- Count of Customers
- Staff Idle time
- Average Waiting time
- · Staff Interaction time
- Suspicious refund %
- Assisted checkout %



Use Case wise Detailed Approach



Traffic Pattern Mapping

Manager Office Activity

Stockroom Freight Dwell

Transaction Oversight at

Input video feed: Self-checkout areas Input video feed: All 13 cameras from across store

Input video feed: Managers' office Input video feed: Custom annotated data from Stockroom cameras

Input video feed: Legacy Point of Sale/ Register Camera

Process

- · Identify checkout counters and individuals using Object Detection model Yolov8
- · Leverage Bot-SORT, a multi-object tracking model to detect and track all the individuals in a scene, while keeping a unique identifier for each object
- · Use Fast ReID for re-identification of individuals across non-overlapping camera views
- Differentiate employees and customers through prolonged presence i.e. user IDs present for more than two consecutive 30-minute intervals indicates employees
- An interaction is considered a checkout if customers' total time is at least 25% of the transaction time
- · Checkouts are classified as engaged if employee interaction time exceeds 10 seconds or 10% of the transaction time.

Process

- Create heatmaps for each camera view to track and analyze customer movement
- Use motion detection to identify the most frequented/ high traffic areas/ aisles in-store based on time spent moving/ standing still by individuals (both employees and customers)

Process

- Object detection model is developed to identify the individuals present in office
- Time spent within office is calculated for each employee
- Monitor Idle time per employee and optimize employee schedules

Process

- · Object detection model is used to identify shrink-wrapped pallets in the stockroom, each box is given an ID
- An object tracking model is used to track these pallets across different
- A wrapped pallet is detected & given an ID only if it is in video for 1 min to avoid false positives
- Calculate the amount of time the freight/ pallets remain untouched in the stockroom
- Instances where shrink-wrapped pallets in the stockroom remain untouched for over 36 hours, are recorded and flagged

Process

Analysis correlates and validates video feed data with point-of-sale (POS) transaction data

- Use Yolov8 to identify the counter area
- Distinguish employees from customers based on whether an individual is inside/ outside the counter area
- Detect refund transactions from the POS data and examine transaction activity at the legacy counter during the same time
- Pose detection model is used detect employee hands in the counter area
- Transactions are flagged as suspicious if there is no customer present during the time of the refund transaction

Output: Engaged vs Non-Engaged Checkout

Output: Peak Areas of customer Interest based on insights from the heatmap

Output: Idle time per employee **Output:** Number of Hours pallet remains un-opened

Output: Suspicious vs Non-Suspicious transactions

Video Stream Processing leveraging Nvidia Deepstream

Streaming video framework

- GStreamer
- Nvidia Deepstream
- Low latency framework for video processing

Edge Inference machines/servers

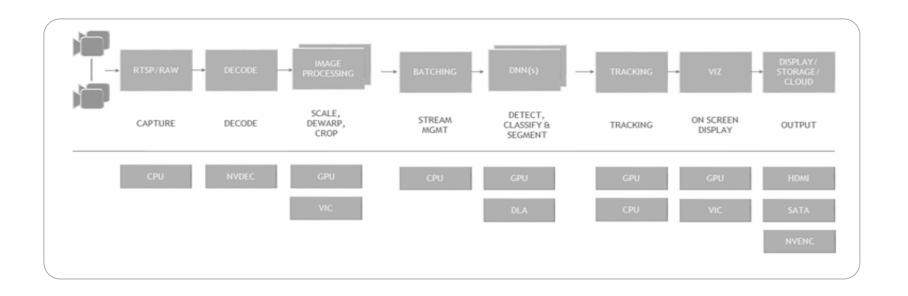
- Nvidia Jetson Orin AGX
- Real-time simultaneous model inference from multiple streams in single GPU

Model runtime

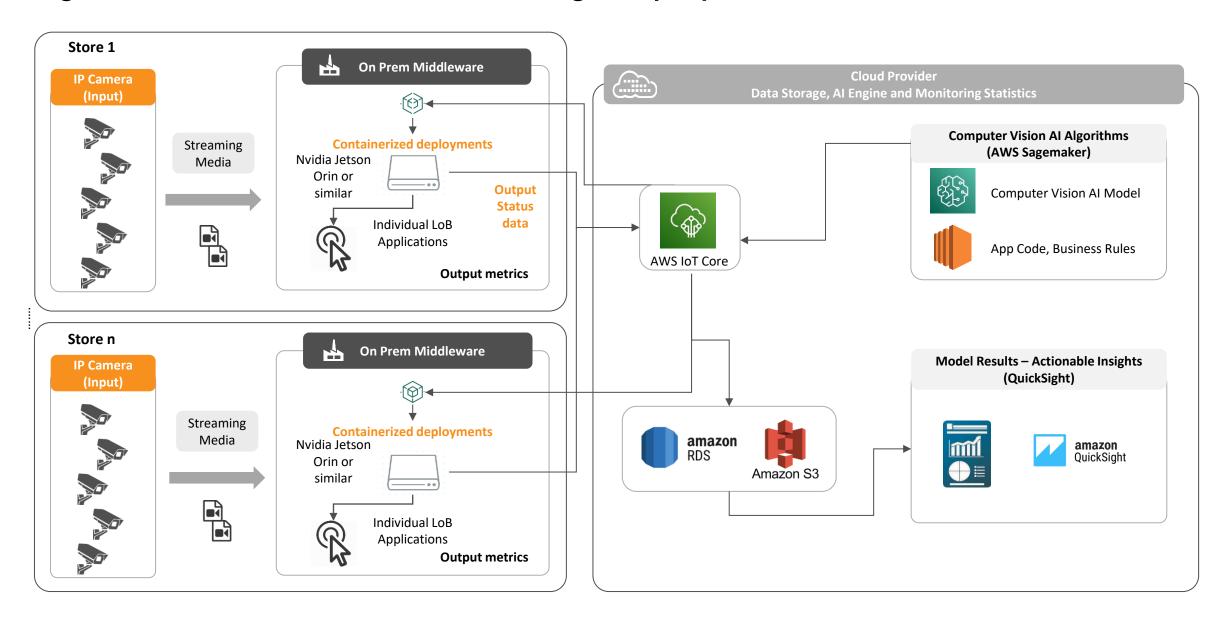
- ONNX runtime
- Framework for model optimization for low latency inference

Over the air updates / Cloud integration

- Azure IOT hub
- Containerized deployments
- Device health monitoring, containerized deployments and model updates



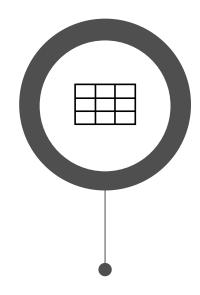
High-Level Architecture on AWS - Edge Deployment



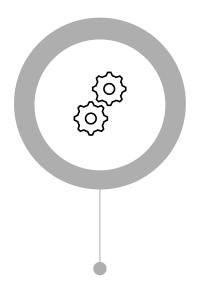
Business Outcome



Al-based solution using computer vision models to enable data-driven insights



Heatmaps that offer a
clear visual
representation of the
most and least visited
aisles and/or areas within
the store



Compute various metrics for monitoring employee dwell time, assisted checkout engagement %, suspicious transactions% along with list of all void transactions



User-friendly dashboards that enables retail stores to improve their operational efficiency and reduce likelihood of theft

03 Select Use Cases - Retail CV

Select Examples of Our Experience in Computer Vision based Solutions

Business Problem







Value Delivered





Retail Use cases:

End to End Computer Vision Platform for a major CPG Client

Building an end-to-end computer vision capability that will help democratize, standardize and scale up the consumption of computer vision-based automation and insights globally

Our solution is expected to significantly improve operational and sales KPIs at lower cost



Retailer of Diamond Jewelry:

Al Powered Image Quality Detection for Jewellery Repair Process

Developed an advanced analytics solution to determine image quality for processing diamond jewellery repair audits with an accuracy of >95%.

Comprehensive audits ensuring scrutiny for 100% of all diamond repairs compared to current manual audit process which covers <30% of repairs



Performance Monitoring:

Computer Vision to Measure Endcap Performance for a large Specialty Retailer Developed a model to evaluate the impact of limited time promotions - End Cap fixtures in driving customer engagement in-store using video analytics ~2X interactions detected around wine endcaps with LTS discount compared to wine endcaps with no discount



Thank You

Do you have any questions?

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