AI Vision Patent Portfolio
Executive Summary

This portfolio spans **50+ issued and pending patents** covering the core building blocks of next-generation computer vision. Together, they protect not just narrow features, but the **entire stack needed for scalable, real-time, privacy-sensitive visual AI**.

One digestible way to organize them is into six pillars:

1. Recognition & Identification

Patents that make machines **see and identify reliably**, even under imperfect conditions:

- **Pose-invariant recognition** – converts side-views into normalized front views; critical for faces, products, and security.
- **Partial / occluded face reconstruction** – recognizes people even with masks, hats, or partial views.
- **Age estimation & iris recognition at distance** – specialized biometric capabilities for checkout, fraud prevention, and secure access.
- **Fast, compact feature extraction & comparison** – enables privacy-preserving, on-device recognition for regulated industries.

Why it matters: Ownership of the core IP needed for accurate, real-time identity and product recognition across retail, robotics, security, consumer devices, IoT, etc.

2. Enrollment & Ultra-Fast Edge Recognition

Patents that enable **rapid, memory-efficient, and private enrollment of new objects or identities**:

- **Rapid enrollment:** New objects, faces, or products can be added with just a few images — no retraining cycles.

- **Compact storage:** Embedding-based representation enables **tens of thousands of items** to be stored on-device with minimal memory.

- **Private & on-device:** Matching and recognition happen locally, without cloud dependence, supporting **privacy-first deployments** in regulated industries.

- **Ultra-fast matching:** Millisecond-level comparisons at the edge make recognition practical in real-time environments.

Why it matters: This gives the portfolio a **unique moat** — instant adaptability, scalability, and privacy — essential for retail (new SKUs), robotics (teaching new tools), AR/VR personalization, security applications, etc.

3. Retail & Commerce Automation

Patents tailored to **retail shelves, checkout, and inventory**:

- Automated **shelf scanning** and **planogram compliance** (detecting missing, misplaced, or incorrectly plugged products).

- **Multi-view and multiscale product detection** for carts, conveyor belts, and grab-and-go checkout.

- **Smart bounding boxes (quadrilateral/concave)** for accurate product localization in cluttered retail scenes.

- **False positive reduction and missing-annotation correction** to keep accuracy high in noisy, real-world retail data.

Why it matters: Provides the protected foundation for *automated checkout, shrink prevention, and real-time inventory monitoring*—huge cost savings for retailers.

4. 3D & Generative Vision

Patents that turn **2D into 3D** and generate realistic new views:

- **3D reconstruction from a single image** – build full 3D models of faces or products from one photo.

- **Synthetic multi-angle image generation** – create new views for training, try-ons, or grasp planning in robotics.

- **Photorealistic face synthesis & editing** – controllable avatars, AR/VR presence, personalization.

- **Rapid 3D face reconstruction** and **3D spatial transformer networks** – efficient pipelines for AR shopping, virtual fitting, and metaverse applications.

Why it matters: Opens markets in robotics training and manipulation, AR/VR shopping, digital twins, synthetic media, etc..

5. Efficient & Scalable AI Architectures

Patents that make models **smaller, faster, and cheaper** to deploy:

- **Perturbative neural networks & polynomial CNNs** – radically reduce parameters while keeping accuracy.

- **Pruning & compression frameworks** – structured removal of low-value filters; optimized deployment on edge/IoT.

- **Binary networks & lightweight feature pooling** – energy-efficient models for mobile and embedded vision.

- **Automated neural architecture search (NAS)** – reinforcement learning that discovers optimal, compact models automatically.

Why it matters: Locks up key techniques for **edge AI**—running advanced recognition on phones, glasses, cameras, robots, and drones without reliance on the cloud.

6. Action, Security & Specialized Applications

Patents extending vision from recognition to **understanding behavior and risk**:

- **Skeleton-based action recognition** – lightweight motion analysis for security and checkout monitoring.

- **Weapon detection with pose estimation** – automated firearm alerts in venues and retail.

- **Continuous authentication** – seamless verification throughout a session without disrupting the user.

- **Scene rectification & object deformation handling** – boosts accuracy in chaotic, real-world environments.

Why it matters: Secures use cases in public safety, home and corporate security, loss prevention, autonomous monitoring, and compliance—high-stakes areas where false positives are very costly.

Portfolio Takeaways

- **Breadth + depth:** Covers the *entire vision stack*—from raw feature extraction, to enrollment, to 3D reconstruction, to domain-specific retail and security applications.

- **Efficiency as a moat:** Many patents focus on *doing more with less compute*—a decisive edge for mobile, edge, and robotics.

- **Cross-domain leverage:** The same primitives (pose-invariance, few-shot detection, lightweight architectures, compact enrollment) apply to retail, robotics, AR/VR, biometrics, and beyond.

- **Barrier to entry:** Competitors building practical visual AI systems have a good chance of running into this IP— creating violations or forcing workarounds that may result in inferior performance.

This portfolio isn’t just a collection of algorithms.

It’s an intertwined defensible moat across the fastest-growing sectors of vision AI—automated retail, AR/VR personalization, robotics, and edge security.