

Investment Opportunities in Computer Vision Technology

Purpose: The purpose of this research is to identify the applications of the computer vision technology for which the specific market has not become saturated while is still big enough.

Assumptions:

- 1. The fundamental computer vision technology is almost a commodity. Therefore, it will be difficult for companies to use a value-based pricing model. Instead, **companies would more likely use a market pricing model** - namely competition-based pricing model.
- 2. Most of the computer vision companies will be serving businesses instead of individuals directly. Therefore, **it is more likely that companies will charge on an account basis** instead of a usage basis. However, it is not always the case, and there can be some tiered pricing for different accounts based on usage.
- 3. We assume **Pitchbook has covered most of the relevant startups**.

Industry	Applications	Key market size drivers	Data/Estimation (US, annualized)	Source/Explanation	# of Startups in notable markets (Source: Pitchbook)
Agriculture, Forestry, Fishing and Hunting	A. Disease monitoring B. Maturity monitoring C. Fruit picking robot D. Maintenance/repair E. Soil condition monitoring F. Food/agricultural product processing	1. \$ of cost caused by diseases 2. \$ of labor cost (seasonal workers) 3. \$ of harvesting labor cost per acre 4. # of acres of forestry 5. # of acres of farm lands 6. # of farms 7. \$ TAM of fruit picking	1. Variable 2. \$11.14/hour (seasonal workers) 3. \$20,174 (strawberry harvest) 4. 514,425,000 (timberland) 5. 899,500,000 6. 2,029,200 7. \$5.16 billion - \$10.91 billion	1. N/A 2. Source (Payscale, 2019) 3. Source (UC Davis, 2016) 4. Source (Statista, 2018) 5. Source (Statista, 2018) 6. Source (Statista, 2018) 7. Source (Plug and Play Ventures, 2019)	1. Fruit picking/harvesting robot (\$5.16 billion - based on labor cost saved): 10 2. Soil/disease monitoring (> \$1B): 20
Mining	A. Asset counting/monitoring B. Maintenance/repair	1. # of mines	1. 6,778	1. Source (USGS, 2019)	N/A
Utilities	A. Asset monitoring B. Maintenance/repair	1. # of equipment 2. # of utility companies 3. # of miles of pipelines	1. Variable 2. < 50 3. 2,741,128 (oil and gas)	1. N/A 2. Estimated 3. Source (US DOT, 2016)	1. Powerline/pipeline inspection (<\$1B): 27
Construction	A. Working environment safety/compliance monitoring B. Asset counting/monitoring C. Maintenance/repair	1. # of construction sites 2. # of construction workers 3. # of worker fatalities 4. # of non-fatal injuries 5. \$ cost per medically consulted injury 6. \$ cost per death 7. # of construction companies	1. 1,242,300 (private housing projects) 2. 8,438,000 (production) 3. 971 (20.7% of all industries) 4. 82,800 5. \$39,000 6. \$1,150,000 7. 3,169,366 a. Top 5 companies control <3% market share in total b. <82% of the companies have <10 employees c. 1% of the companies have >100 employees	1. Source (Statista, 2018) 2. Source (BEA, 2017) 3. Source (US DOL, 2017) 4. Source (US DOL, 2016) 5. Source (NSC, 2017) 6. Source (NSC, 2017) 7. Source (IBISWorld, 2018)	1. Construction site safety monitoring (\$4.35 billion - based on loss): 18
Manufacturing	A. Working environment safety/compliance monitoring B. Product QA/assembly C. Component tracking D. Maintenance/repair	1. # of manufacturing factories 2. # of total area of manufacturing facilities 3. # of worker fatalities 4. # of non-fatal injuries 5. \$ cost per medically consulted injury 6. \$ cost per death 7. \$ labor cost (manufacturing) 8. # of workers	1. 292,825 (all factories) 2. 24,856 (> 100 workers) 3. 3,452.02 million sq. ft. 4. 303 5. 394,600 6. \$39,000 7. \$1,150,000 8. \$15.20/hour 9. 12,846,000	1. Source (US DOL, 2015) 2. Source (JLL, 2019) 3. Source (US DOL, 2017) 4. Source (US DOL, 2017) 5. Source (NSC, 2017) 6. Source (NSC, 2017) 7. Source (Payscale, 2019) 8. Source (US BLS, 2019)	1. Workplace safety monitoring (\$15.74 billion - based on loss): 62
Wholesale Trade	A. Autonomous warehouse robot B. Asset counting/monitoring	1. # of area of warehouses 2. # of warehouses 3. \$ of warehouse worker salary 4. # of warehouse workers	1. 9,766.42 million sq. ft. 2. 18,182 3. \$30,765 base per year 4. 1,194,500	1. Source (JLL, 2019) 2. Source (US DOL, 2018) 3. Source (Glassdoor, 2019) 4. Source (US BLS, 2019)	1. Warehouse robot (\$ multiple billion - based on labor cost saved): 60
Retail Trade	A. Shelf content monitoring B. Vending machine content monitoring C. Retail space traffic tracking/monitoring	1. # of retail stores 2. # of retail spaces (area) 3. # of automatic vending machines	1. 450,940 (total) 2. 154,958 (convenience stores) 3. 7,653.95 million sq. ft. 4. ~13% vacancy rate 5. 4.6 million	1. Source (Statista, 2017) 2. Source (PwC) 3. Source (NAR) 4. Source (Brandongaille, 2017)	1. Retail/general space visitor monitoring (\$432.90M - assuming 8 cameras each store and \$10 per month per camera): 27

	D. Security/anti-theft monitoring				
Transportation and Warehousing	A. Autonomous driving B. Delivery robot C. Passenger monitoring D. Driver monitoring E. Autonomous warehouse robot F. Asset counting/monitoring G. Maintenance/repair H. Asset tracking I. Airport luggage tracking J. Airport ground operations tracking (Source) K. Airport runway monitoring and inspection	1. # of autonomous cars sold 2. # of restaurants 3. # of cars sold 4. # of trucks sold 5. # of trucks 6. # of truck drivers 7. \$ of truck driver salary 8. # of buses 9. # of bus drivers 10. \$ of bus driver salary 11. # of cars for rental 12. # of car rental trips 13. # of car rental companies 14. # of airports 15. # of airport boarding gates 16. # of airport baggage carousels	1. 1 million projected 2. 660,755 3. 5.3 million (passenger car, US) 11.9 million (light-duty, US) 77 million (car, global) 4. 487,900 (heave-duty) 5. 36 million with 3.68 million being class-8 trucks (for business purposes) 6. 1,871,700 7. \$43,680 8. 411,017 (public buses) 9. 687,200 10. \$42,080 11. 2,212,925 12. 807.4 million 13. 100s with ~20 being big ones 14. 5,104 (public) 14,263 (private) 15. 9,481 - 13,000 (public) 16. 6,000 (public)	1. Source (IHS, 2025) 2. Source (NPD Group) 3. Source (Statista, 2018) Source (Statista, 2018) Source (Statista, 2018) 4. Source (Statista, 2018) 5. Source (ATA, 2017) 6. Source (US BLS, 2016) 7. Source (US BLS, 2018) 8. Source (US DOT, 2017) 9. Source (US BLS, 2016) 10. Source (US BLS, 2018) 11. Source (AutoRentalNews, 2018) 12. Source (IBISWorld, 2020) 13. Estimated 14. Source (Statista, 2018) 15. Source (Plug and Play Ventures) 16. Source (Plug and Play Ventures)	1. Autonomous truck (\$81.73 billion - based on labor cost saved): 25 2. Autonomous bus (\$28.92 billion - based on labor cost saved): 8 3. Autonomous delivery robot (\$ multiple billion - based on labor cost saved): 65 4. Airport operation monitoring (<\$1B): 24 5. Autonomous car inspection (\$1.6 billion - assuming \$2 per inspection): 26
Information	A. Object/image categorization B. Facial recognition C. 3D reconstruction from multiple images	1. N/A (companies in this industry usually have internal teams to handle the needs)	1. N/A	1. N/A	N/A
Finance and Insurance	A. Automatic filing B. Automatic claiming	1. # of finance institutions 2. # of insurance institutions 3. \$ of premium written 4. # of insurance carriers 5. # of insurance agencies, brokerages and related services providers 6. % of auto insurance claim frequency 7. \$ of claim severity 8. \$ of car damage adjuster salary 9. # of insured private passenger cars	1. 471 (annual rev > \$1B) 797 (annual rev > \$500M) 2,384 (annual rev > \$100M) 2. 434 (annual rev > \$1B) 664 (annual rev > \$500M) 1,801 (annual rev > \$100M) 3. \$546.800 billion (Life) \$830.315 billion (Non-life) 4. 1,519,900 (total) 1,494,000 (direct insurers) 25,900 (reinsurers) 5. 1,135,700 (total) 804,900 (agencies and brokerages) 330,900 (related service providers) 6. 1.1% (bodily injury, liability insurance) 4.0% (property damage, liability insurance) 6.2% (collision insurance) 2.85% (comprehensive insurance) 7. \$15,270 (bodily injury, liability insurance) \$3,638 (property damage, liability insurance) \$3,425 (collision insurance) \$1,817 (comprehensive insurance) 8. \$49,462/year (\$16-\$20/hour) 9. 202.68 million	1. Source (D&B Hoover, 2019) 2. Source (D&B Hoover, 2019) 3. Source (Insurance Information Institute, 2017) 4. Source (Insurance Information Institute, 2017) 5. Source (Insurance Information Institute, 2017) 6. Source (Insurance Information Institute, 2017) 7. Source (Insurance Information Institute, 2017) 8. Source (Glassdoor, 2019) 9. Source (Insurance Information Institute, 2015)	1. Automatic claiming (~ \$1 billion - based on labor cost saved): 19
Real Estate Rental and Leasing	A. Property inspection B. Automatic filing	1. # of building inspectors 2. \$ of building inspector salary 3. \$ of building inspection industry revenue 4. # of real estate rental/leasing companies	1. 25,164 (companies) 98,810 (individuals) 2. \$62,020/year (\$29.82/hour) 3. \$3.9 billion (CAGR = 2.1%, \$4.3 billion in 2024, 24.5% margin, no dominating company)	1. Source (IBISWorld, 2019) Source (US BLS, 2017) 2. Source (US BLS, 2017) 3. Source (IBISWorld, 2019) 4. Source (D&B Hoovers, 2019)	1. Property inspection (<\$1B): 10

			4. 178 (annual rev > \$500M) 465 (annual rev > \$100M) 744,211 (total)		
Professional, Scientific, and Technical Services	A. Automatic filing	1. # of professional service companies	1. 234 (annual rev > \$1B) 460 (annual rev > \$500M) 1,974 (annual rev > \$100M)	1. Source (D&B Hoovers, 2019)	N/A
Management of Companies and Enterprises	A. N/A	1. N/A	1. N/A	1. N/A	N/A
Administrative and Support and Waste Management and Remediation Services	A. Waste sorting robot	1. \$ waste collection market size 2. # of tons of waste disposed annually 3. \$ collection/recycling cost per ton 4. # of trash collection trucks	1. \$60.76 billion (North America) 2. 262.40 million tons of solid waste (4.48 pounds per capita per day) Paper 25.9%, Food 15.1%, Yard trimmings 13.3%, Plastics 13.1%, Rubber, leather and textiles 9.3%, Metals 9.1%, Wood 6.2%, Glass 4.4%, Other* 3.6% 3. \$50 - \$150/ton (curbside recycling program) \$70 - \$200/ton (trash collection and disposal program) 4. Between 93.02K and 148.84K (private sector) 200K+ (private + public sectors)	1. Source (The Business Research Company, 2019) 2. Source (Statista, 2015) 3. Source (ThoughtCo) 4. Source (IBISWorld, 2019)	1. Waste sorting/recycling (\$1.42 billion - assuming \$5 per ton): 11 2. Collection digitization & optimization (\$1.2 billion - assuming \$500 per truck per month): 0
Educational Services	A. Scoring B. Student behavior/interaction tracking	1. # of schools 2. # of teachers 3. # of students	1. 137,032 (total) 66,837 (elementary, public) 21,907 (elementary, private) 23,814 (secondary, public) 2,946 (secondary, private) 6,783 (combined, public) 9,723 (combined, private) 724 (other, public) 4,298 (degree-granting postsecondary institutions) 2. 3,169,000 (elementary/secondary, public) 485,000 (elementary/secondary, private) 3. 76.41 million Nursery 2.78M (public)/1.89M (private) Kindergarten 3.54M (public)/0.42M (private) Elementary 29.87M (public)/2.66M (private) High school 15.55M (public)/1.30M (private) College 14.81M (public)/3.59M (private)	1. Source (NCES, 2016/17) Source (US News) 2. Source (NCES, 2016) 3. Source (US Census Bureau, 2017)	N/A
Health Care and Social Assistance	A. Disease diagnostics B. Medical imaging C. Reducing attrition in clinical trials D. Surgery	1. # of hospitals 2. # of doctors 3. # of surgeries	1. 5,262 (total) 972 (State/local government) 2,968 (Non-profit) 1,322 (For-profit) 2. 870,900 (active doctors) 3. 36,457,210	1. Source (American Hospital Association, 2017) 2. Source (American Medical Association, 2015) 3. Source (WHO, 2007)	N/A
Arts, Entertainment, and Recreation	A. Sports player tracking/analytics B. Audience engagement (facial recognition)	1. # of sports teams/clubs 2. \$ of budget on analytics/performance improvement annually 3. \$ of revenue	1. 368 (total, US) 1,508 (top global leagues) 156 (big five leagues) - National Football League (32)	1. Source (Wikipedia, 2019) Source (Wikipedia, 2019) 2. Source (SI.COM, 2018) 3. Source (Wikipedia, 2019)	1. Sports analytics (\$817.3M - global, assuming 1% of big teams' revenue, not including broadcasting and gambling markets):

	C. Art forgery identification	4. # of event facilities/venues 5. # of artworks sold 6. \$ of artworks sold	- Major League Baseball (30) - National Basketball Association (30) - National Hockey League (31) - Major League Soccer (1,996) - Canadian Football League (9) 212 (Other professional teams) 2. 6% - 10% of NBA team's revenue spent on team staff cost (including coaches, medical staff, operations staff) 3. \$32.50B (big five leagues) \$81.73B (global top leagues) National Football League \$13.0B Major League Baseball \$9.5B National Basketball Association \$5.2B National Hockey League \$3.7B Major League Soccer \$0.9B Canadian Football League \$0.2B 4. 1,230 games for NBA (82 games each team for one regular season) 5. 39 million transactions (global) 16.38 million (US, estimated) 6. \$63.74 billion (global) \$27 billion	4. Source (Quora, 2018) 5. Source (UBS, Art Basel, 2018) 6. Source (UBS, Art Basel, 2018)	24
Accommodation and Food Services	A. Room cleanliness monitoring B. Food cleanliness/safety monitoring C. Facial recognition (check-in/out) D. Restaurant traffic monitoring E. Occupancy monitoring F. Hotel room cleaning robot G. Restroom cleaning robot	1. # of hotels 2. # of hotel rooms 3. \$ revenue of hotels 4. # of restaurants 5. # of airbnbs 6. # of toilets 7. \$ of hourly wage of toilet cleaner	1. 54,200 hotel properties 2. 5 million hotel rooms and 1.1 billion guest nights 3. \$208 billion 4. 660,755 5. 0.66 million (US) 6 million (global) 6. 225 million (residential) 75 - 125 million (commercial) 7. \$9/hour	1. Source (American Hotel and Lodging Association, 2019) 2. Source (American Hotel and Lodging Association, 2019) 3. Source (STR Global, 2017) 4. Source (NPD Group) 5. Source (iPropertyManagement, 2018) 6. Source (Flushmate, 2003) 7. Source (Glassdoor, 2019)	1. Autonomous cleaning robot (\$ multi billion): 65 2. Toilet/restroom cleaning robot (\$5.85 billion - based on labor cost saved): 0
Other Services (except Public Administration)	A. Facility security monitoring	1. # of car dealerships 2. # of CCTV cameras	1. 18,251 2. 30 million or 39.83 million (176 million in China)	1. Source (Automotive News, 2017) 2. Source (Wikipedia, 2011) Source (Statista, 2014) Source (Statista, 2017)	1. Security monitoring (\$3.60 billion - assuming \$10 per month per camera): 163
Public Administration	A. Public security monitoring B. Traffic monitoring / Pedestrian detection	1. # of traffic lights 2. # of street lights 3. # of CCTV cameras	1. 300,000 2. 26 million (US) 315 million (global) 3. 30 million or 39.83 million (176 million in China)	1. Source (US Access Board, 2019) 2. Source (BostonGlobe, 2012) Source (Prnewswire, 2016) 3. Source (Wikipedia, 2011) Source (Statista, 2014) Source (Statista, 2017)	1. Security monitoring (\$3.60 billion - assuming \$10 per month per camera): 163