Facial Recognition

Patent Landscape & Competitor Comparison

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Introduction

Facial recognition is a method of identifying or verifying the identity of an individual by analyzing patterns based on the person's facial contours. Facial recognition technology is being applied to a wide range of application areas such as law enforcement, security and authentication. The facial recognition market is expected to grow to $9.6 billion by 2022, registering a CAGR of 21.3% during the forecast period of 2016-2022. [1]

In this report, we have analyzed the currently active published patent applications owned by entities working in facial recognition related technologies. These include companies such as Canon, Samsung, Fujifilm, Sony, Oppo and Intel. Unless otherwise stated, the report displays numbers for published patent applications that are currently in force. The analytics are presented in the various charts and tables that follow. These include the following,

- Taxonomy
- Summary
- Technology Trends
- Key Geographies
- Emerging Players
- Top Players - Portfolio Makeup
- Publication Trend – Top Players
- Geographic Distribution – Top Players
- Technology Distribution – Top Players
- Patent Quality – Top Players
- Comparative Topic Map – CPC Codes
- Competitor Comparison

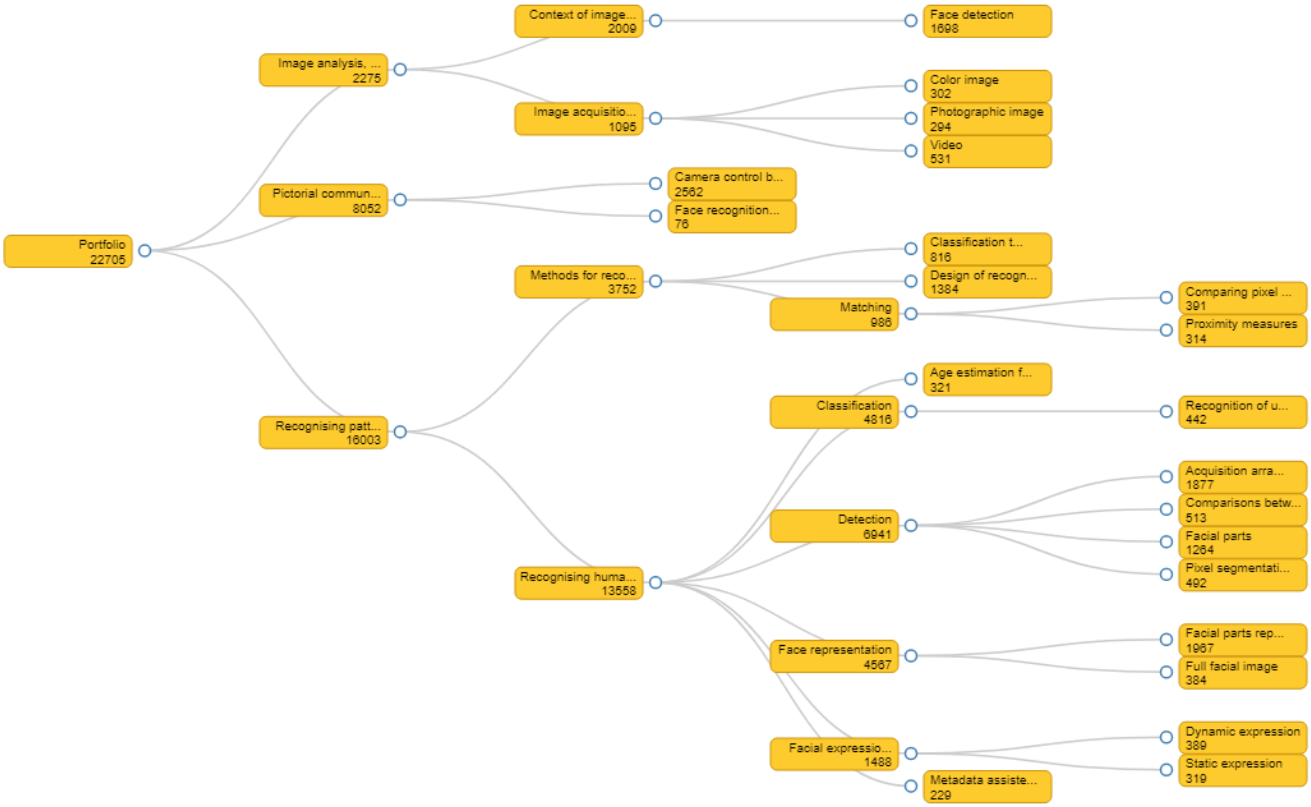
Insights

- Canon and Samsung are the largest patent holders among the companies working in facial recognition technologies.
- A significant upward trend is observed post 2015 in the overall number of published patents.
- China is the preferred filing jurisdiction with more than 40% publications, followed by the US with 25% publications.
- Oppo and Xiaomi are the top emerging/new players in this technology space (i.e. entities with published applications only from 2014).
- Most of the of the emerging/new players in this technology space are based in China.
- Post 2015, the published applications of Oppo covering facial recognition technologies exhibit a sharp increase, whereas Fujifilm's publication trend in similar technology areas shows a decline starting in 2011.

References

1. Facial Recognition Market (Alliedmarketresearch.com)

Taxonomy



Summary

TOTAL DOCUMENTS COUNT

22,705 (APPLICATIONS)

PUBLICATION TYPES

12,610 | 9,870

Applications | Grants

Peak Year of Activity

2018 (6,167)

IP TYPES

22,136 | 546

Invention | Model

Top Patent Holder CANON (1,084)

No of technologies 327

PATENT BY STAR RATING

2.18

★★★★★	77
★★★★☆	389
★★★☆☆	4,560
★★☆☆☆	16,210
★☆☆☆☆	1,469

Top Active Jurisdiction

CN (9,619)

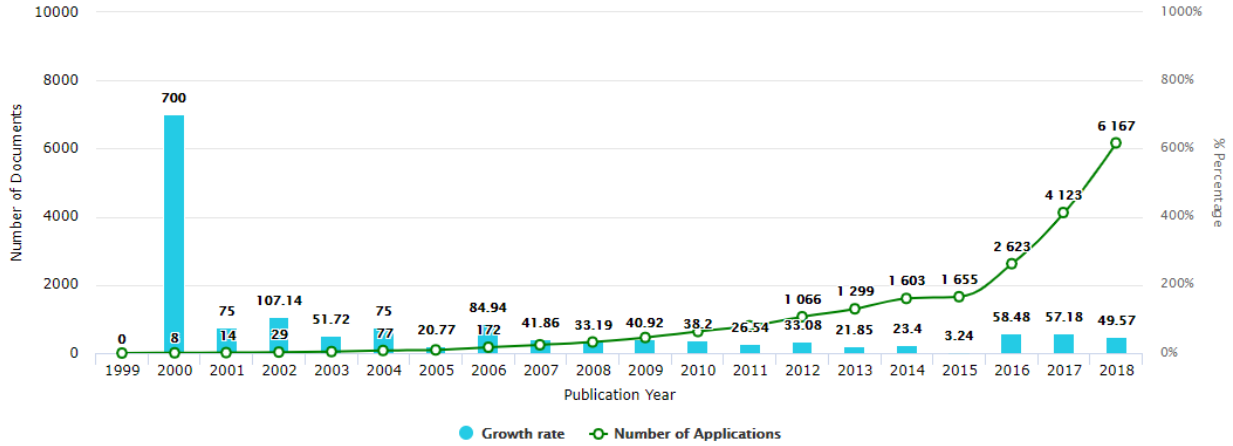
Top Rated

US8659548B2 (5)

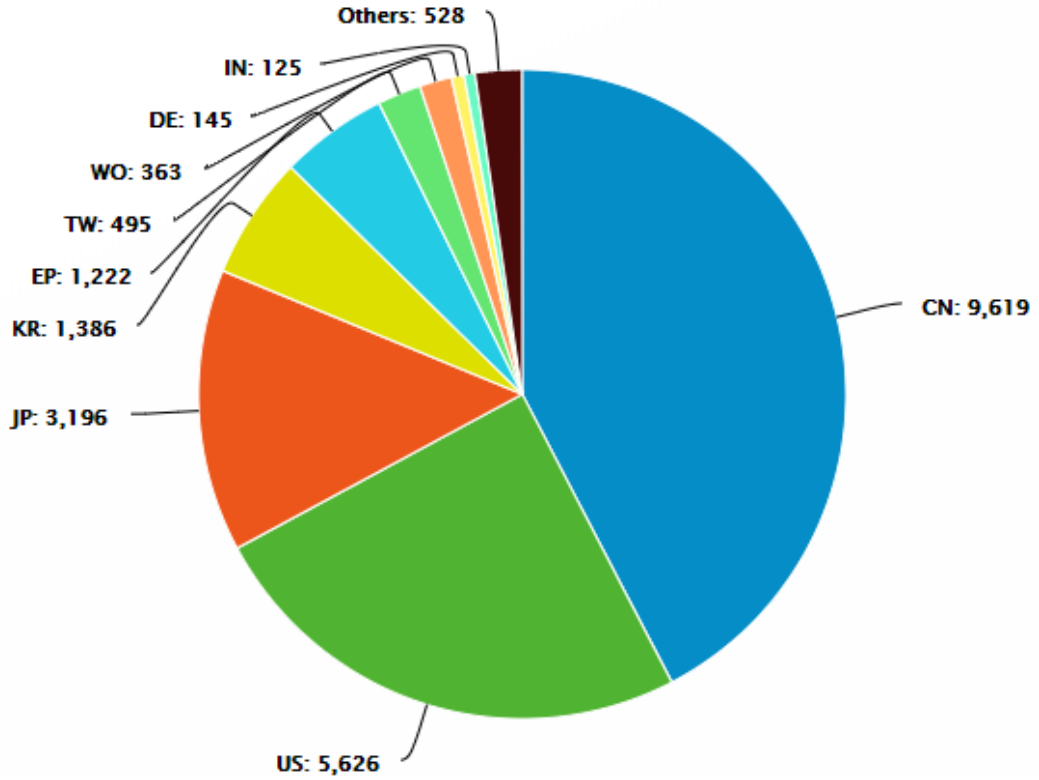
Top Cited

US8659548B2 (552)

Technology Trends



Key Geographies



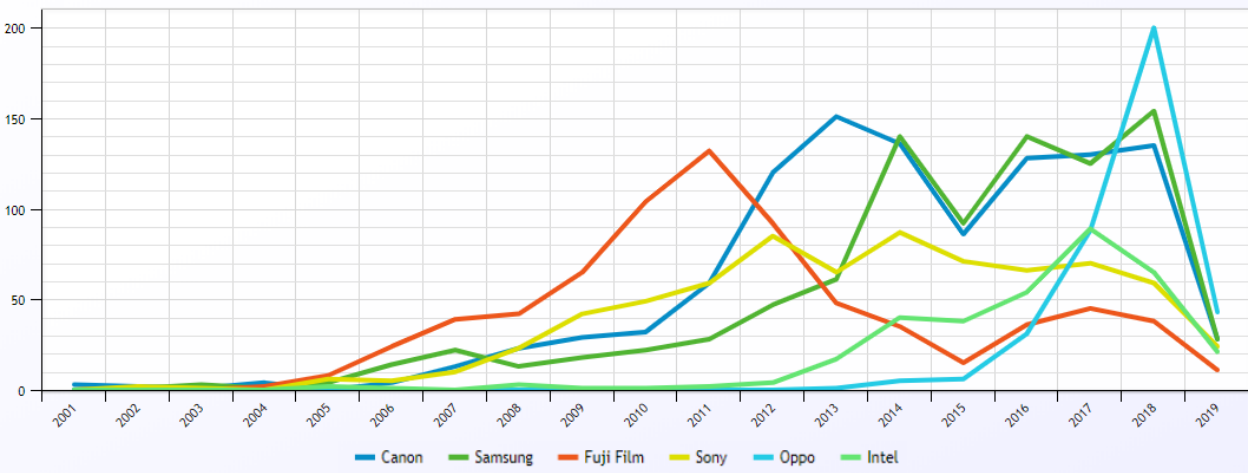
Emerging Players (Entities with published applications only from 2014)

Emerging Top Patent Holders 2014 - present	# Applications	Type	Country
OPPO	393	Consumer electronics	China
XIAOMI	219	Consumer electronics	China
MEGVII	138	AI technology	China
VIVO	106	Consumer electronics	China
SENSETIME	92	AI technology	Hong Kong
ALIBABA	81	E-commerce	China
AMAZON	72	E-comm, cloud computing	USA
XIAOKONG	65	Tech hub	China
BOE TECHNOLOGY	58	Display products	China
PING AN TECH	55	AI technology	China
KUANGSHI TECHNOLOGY	53	Software	China
NUBIA TECHNOLOGY	46	Consumer electronics	China
ZTE	46	Telecommunication equipment	China
UNIVERSITY OF NANJING POSTS & TELECOMMUNICATIONS	40	Academic	China
CAL-COMP	38	Research	Thailand
QIHOO TECHNOLOGY	37	Internet	China
FORD	33	Automobile	USA
INTELLIFUSION	32	AI technology	China
UTECHZONE	32	Optical imaging	Taiwan
MEITU ZHIJIA	30	Software	China

Top Players - Portfolio Makeup

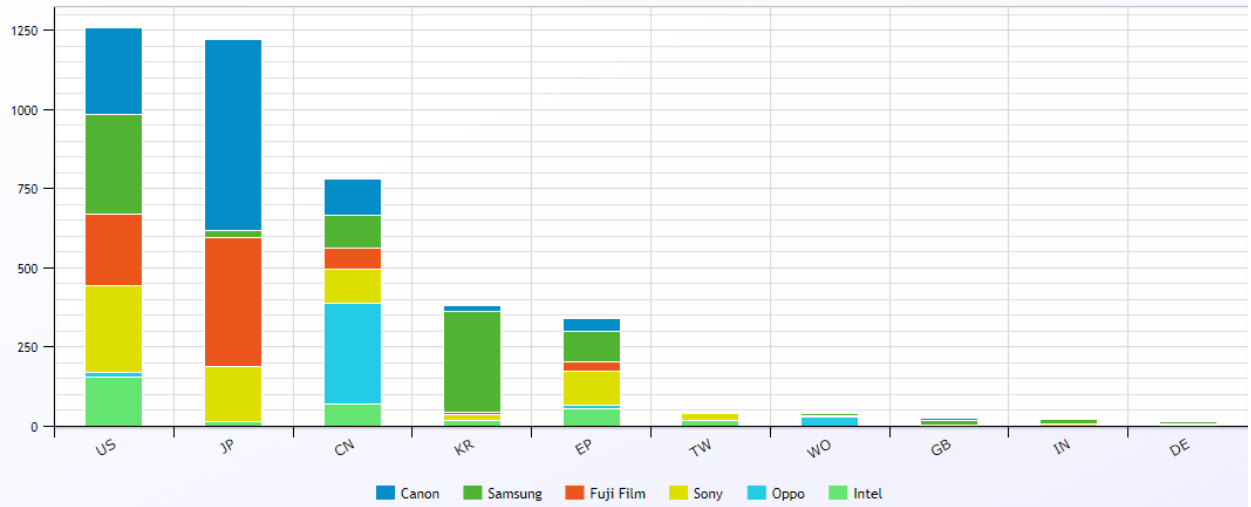
Patent Holders	# Applications	# Families	Top Jurisdictions	Organic (# Applications)	Acquired (# Applications)	Transferred from
Canon	1084	708	JP (601), US (275), CN (115)	1084		
Samsung	913	459	KR (318), US (315), CN (105), EP (94)	881	32	Hanwha (14), Harman (8)
Fujifilm	737	461	JP (405), US (225)	461		
Sony	724	370	US (272), JP (173), CN (108), EP (108)	724		
Oppo	374	325	CN (317)	374		
Intel	338	149	US (154), CN (72), EP (54)	330	8	INVISION BIOMETRICS (4), OLAWORKS (4)

Publication Trend – Top Players



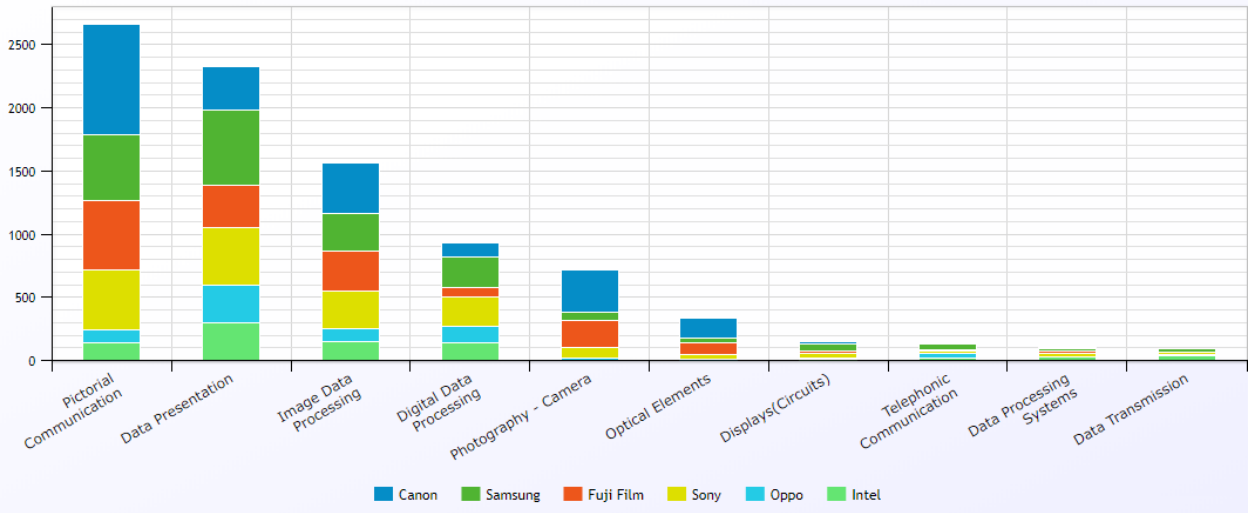
Pub Year	Canon	Samsung	Fujifilm	Sony	Oppo	Intel
2001	3					
2002	2	1	1	2		
2003	1	3		1		
2004	4	1	2			
2005		4	8	6		2
2006	4	14	24	5		1
2007	13	22	39	10		
2008	23	13	42	23		3
2009	29	18	65	42		1
2010	32	22	104	49		1
2011	59	28	132	59		2
2012	120	47	92	85		4
2013	151	61	48	65		17
2014	136	140	35	87	5	40
2015	86	92	15	71	6	38
2016	128	140	36	66	31	54
2017	130	125	45	70	88	89
2018	135	154	38	59	200	65
2019	28	28	11	24	43	21

Geographic Distribution – Top Players



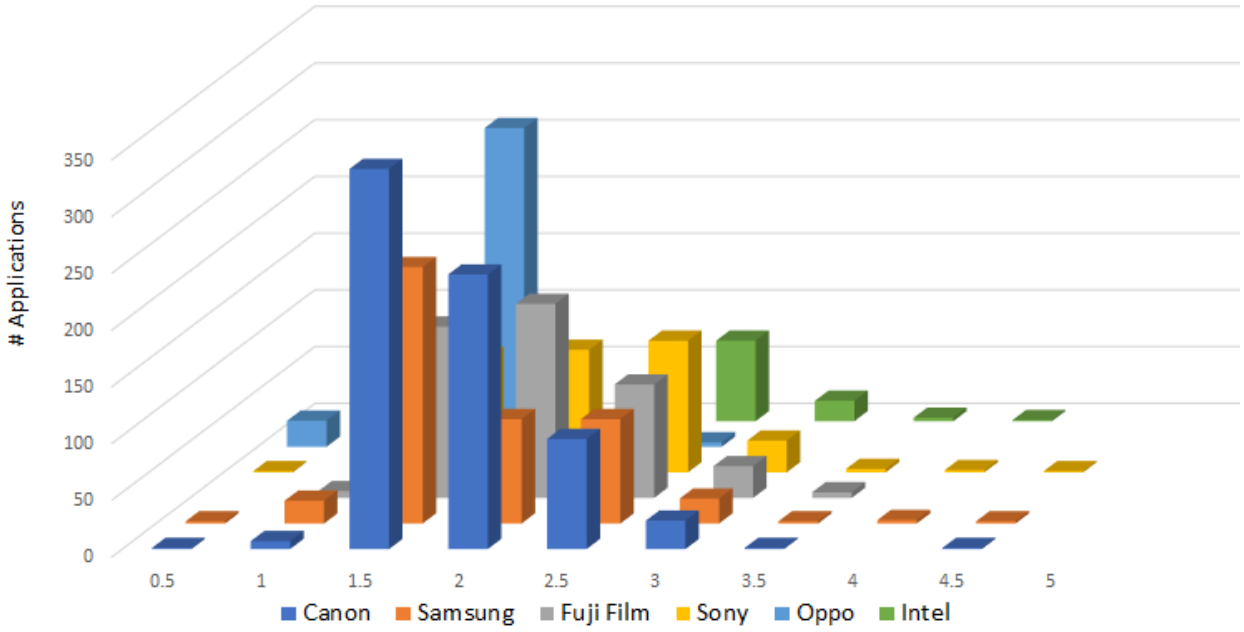
Geographies	Canon	Samsung	Fujifilm	Sony	Oppo	Intel
US	275	315	225	272	17	154
JP	601	25	405	173		16
CN	115	105	64	108	317	72
KR	19	318	6	20		18
EP	43	94	32	108	11	54
TW	1	2	3	20		19
WO	1	7	1	3	28	
GB	9	15		3		
IN	1	13	1	6	1	
DE	6	7		2		4

Technology Distribution – Top Players



Technologies	Canon	Samsung	Fujifilm	Sony	Oppo	Intel
Pictorial Communication	876	513	551	473	110	136
Data Presentation	349	598	331	459	294	299
Image Data Processing	398	292	319	301	96	153
Digital Data Processing	104	244	77	233	128	141
Photography - Camera	335	64	215	84	11	4
Optical Elements	157	34	97	36	6	4
Displays (Circuits)	24	57	15	43	2	12
Telephonic Communication	3	46	5	20	38	19
Data Processing Systems	7	20	17	26	5	27
Data Transmission	4	24	3	23	10	33

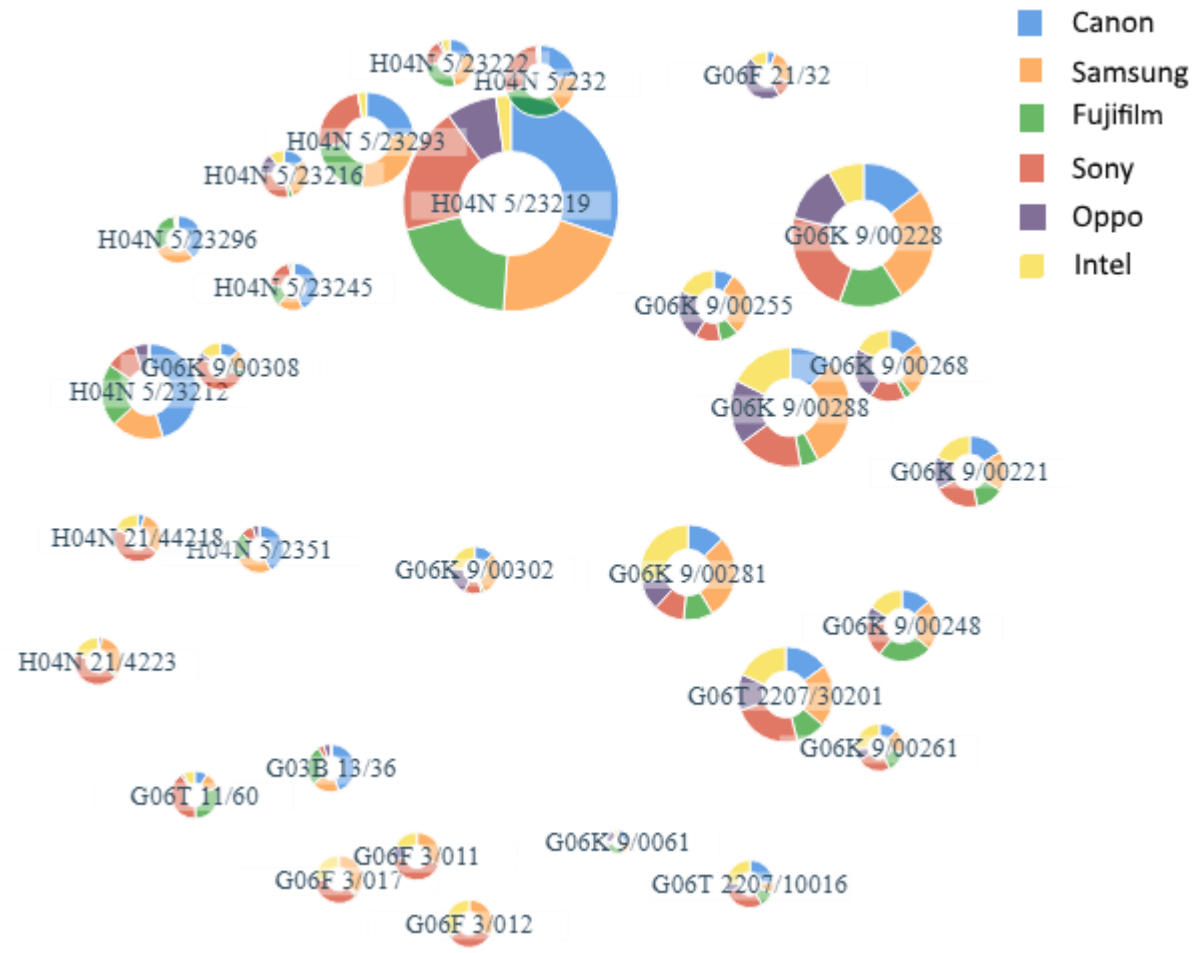
Patent Quality – Top Players *(Relecura Star Rating on a scale of 5)*



Relecura Star Rating	Canon	Samsung	Fujifilm	Sony	Oppo	Intel
0.5	1	2	0	1	23	0
1	7	20	6	10	7	1
1.5	335	226	151	102	281	48
2	242	92	171	108	10	8
2.5	97	92	100	116	4	71
3	25	22	28	28	0	18
3.5	1	2	5	3	0	3
4	0	3	0	2	0	1
4.5	1	2	0	1	0	0
5	0	0	0	0	0	0

Comparative Topic Map – CPC Codes – Top Players

- This Topic Map shows the comparison of CPC codes addressed by the portfolios of Canon, Samsung, Fujifilm, Sony, Oppo and Intel.
- Absolute count comparison: The size of each bubble represents the total number of patent applications across the compared portfolios and the coloured sectors represent relative number of applications in the respective portfolios of each patent holder.
- The bubble proximity corresponds to the "relatedness" of the individual CPC Codes.



Class Code	Description
H04N 5/23219	Hardware or software aspects of TV signals >> where the recognized objects include parts of the human body, e.g. human faces, facial parts or facial expressions
G06K 9/00228	Reading or recognising printed or written characters >> Detection; Localisation; Normalisation
G06K 9/00288	Reading or recognising printed or written characters >> Classification, e.g. identification
H04N 5/23293	Hardware or software aspects of TV signals >> Electronic viewfinders
H04N 5/23212	Hardware or software aspects of TV signals >> Focusing based on image signals provided by the electronic image sensor

Class Code	Description
G06T 2207/30201	Image analysis or enhancement >> Face
G06K 9/00281	Reading or recognising printed or written characters >> Local features and components; Facial parts
G06K 9/00221	Reading or recognising printed or written characters >> Acquiring or recognising human faces, facial parts, facial sketches, facial expressions
H04N 5/232	Hardware or software aspects of TV signals >> Devices for controlling television cameras, e.g. remote control; Control of cameras comprising an electronic image sensor
G06K 9/00268	Reading or recognising printed or written characters >> Feature extraction; Face representation
G06K 9/00248	Reading or recognising printed or written characters >> using facial parts and geometric relationships
G06K 9/00255	Reading or recognising printed or written characters >> using acquisition arrangements
G06F 21/32	Data security and security of computers and components >> using biometric data, e.g. fingerprints, iris scans or voiceprints
G06K 9/00302	Reading or recognising printed or written characters >> Facial expression recognition
H04N 5/23222	Hardware or software aspects of TV signals >> Computer-aided capture of images, e.g. transfer from script file into camera, check of taken image quality, advice or proposal for image composition or decision on when to take image
G06F 3/012	Digital interface arrangements >> Head tracking input arrangements
H04N 21/4223	Interactive TV, Video on demand >> Cameras
G06F 3/017	Digital interface arrangements >> Gesture based interaction, e.g. based on a set of recognized hand gestures
H04N 5/23216	Hardware or software aspects of TV signals >> Control of parameters, e.g. field or angle of view of camera via graphical user interface, e.g. touchscreen
H04N 5/23296	Hardware or software aspects of TV signals >> Control of means for changing angle of the field of view, e.g. optical zoom objective, electronic zooming or combined use of optical and electronic zooming
G06K 9/00308	Reading or recognising printed or written characters >> Static expression
H04N 5/2351	Hardware or software aspects of TV signals >> Circuitry for evaluating the brightness variations of the object
H04N 5/23245	Hardware or software aspects of TV signals >> Operation mode switching of cameras, e.g. between still/video, sport/normal or high/low resolution mode
H04N 21/44218	Interactive TV, Video on demand >> Detecting physical presence or behaviour of the user, e.g. using sensors to detect if the user is leaving the room or changes his face expression during a TV program
G06T 2207/10016	Image analysis or enhancement >> Video; Image sequence
G06T 11/60	Generating 2D Images >> Editing figures and text; Combining figures or text

Class Code	Description
G03B 13/36	Viewfinders, focus systems for cameras >> Autofocus systems
G06K 9/00261	Reading or recognising printed or written characters >> using comparisons between temporally consecutive images
G06F 3/011	Digital interface arrangements >> Arrangements for interaction with the human body, e.g. for user immersion in virtual reality
G06K 9/0061	Reading or recognising printed or written characters >> Preprocessing; Feature extraction

Competitor Comparison – Technology Category-wise Break-up

(# Applications given for color-coded categories)

Technology Categories				Canon	Samsung	Fuji Film	Sony	Oppo	Intel
Image analysis, enhancement	Context of image	Face detection		173	189	104	248	79	127
	Image acquisition modality	Color image		537	457	391	349	49	153
		Photographic image		409	249	204	334	50	166
		Video		550	641	163	799	29	364
Pictorial communication	Camera control by face recognition			774	481	340	556	151	66
	Face recognition by reading patterns			17	17	38	5	0	1
Recognising patterns	Methods for recognition	Classification techniques		233	229	130	171	49	191
		Design of recognition systems		370	378	156	270	74	188
		Matching	Comparing pixel values	188	256	128	158	47	125
			Proximity measures	128	102	53	82	26	37
	Recognising human faces	Age estimation from face		13	18	5	27	10	9
		Classification	Recognition of unknown faces	39	9	25	30	5	5
		Detection	Acquisition arrangements	60	114	36	86	69	49
			Comparisons between images	30	33	26	38	10	39
			Facial parts	84	77	86	93	26	168
			Pixel segmentation, color matching	33	37	26	33	7	29
		Face representation	Facial parts representation	91	153	50	83	60	117
			Full facial image	10	63	13	5	13	11
		Facial expression recognition	Dynamic expression	28	53	12	38	0	42
			Static expression	22	38	8	68	9	20
		Metadata assisted face recognition		12	10	1	24	3	2

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