Supplementary

Table S1 Research strategies

Number	Research strategy	Results
#1	TS=("AMD" OR "Degeneration, Macular" OR "Macular Degenerations" OR "Maculopathy" OR "Maculopathies" OR "Macular Dystrophy" OR "Dystrophy, Macular" OR "Macular Dystrophies" OR "Age-Related Macular Degeneration" OR "Age Related Macular Degeneration" OR "Age-Related Macular Degenerations" OR "Macular Degeneration, Age-Related" OR "Macular Degeneration, Age Related" OR "Maculopathies, Age-Related" OR "Maculopathy, Age-Related" OR "Maculopathy, Age Related" OR "Age-Related Maculopathies" OR "Age Related Maculopathies" OR "Age-Related Maculopathy" OR "Age Related Maculopathy")	43,874
#2	TS=("artificial* intelligen*" OR AI OR "deep learning" OR "convolutional neural network*" OR MTANN OR "artificial neural network*" OR "machine learning" OR "long short term memory" OR "supervised clustering" OR "supervised learning" OR "unsupervised learning" OR "semi-supervised learning" OR "semi supervised learning" OR backpropagation OR "back-propagation" OR "feed forward" OR "feedforward" OR "feature learning" OR "decision tree*" OR "transfer learning" OR "big data" OR "natural language processing" OR "computer vision" OR "image recognition" OR "semantic analys*" OR "cognitive computing" OR "entity annotation*" OR "entity extraction*" OR "machine intelligence" OR "predictive analys*" OR "k-nearest neighbour" OR "k nearest neighbour" OR "neural network*" OR "random forest*" OR "random-forest*" OR "feature extraction" OR "optic cup segmentation" OR "data mining" OR "computer-aided detection" OR "computer aided detection" OR "deep belief fusion" OR "deep-belief fusion" OR "feature fusion" OR "Support vector machine" OR "logistic regression")	1,377,831
#3	#2 AND #1	1,721
#4	TS=("logistic regression")	405,624
#5	#4 AND #1	721
#6	TS=("artificial* intelligen*" OR "deep learning" OR "convolutional neural network*" OR MTANN OR "artificial neural network*" OR "machine learning" OR "long short term memory" OR "supervised clustering" OR "supervised learning" OR "unsupervised learning" OR "semi-supervised learning" OR "semi supervised learning" OR backpropagation OR "back-propagation" OR "feed forward" OR "feedforward" OR "feature learning" OR "decision tree*" OR "transfer learning" OR "big data" OR "natural language processing" OR "computer vision" OR "image recognition" OR "semantic analys*" OR "cognitive computing" OR "entity annotation*" OR "entity extraction*" OR "machine intelligence" OR "predictive analys*" OR "k-nearest neighbour" OR "k nearest neighbour" OR "neural network*" OR "random forest*" OR "random-forest*" OR "feature extraction" OR "optic cup segmentation" OR "data mining" OR "computer-aided detection" OR "computer aided detection" OR "deep belief fusion" OR "deep-belief fusion" OR "feature fusion" OR "Support vector machine")	939,763
#7	#6 AND #1	918
#8	TS=(Tomography, Optical Coherence(MeSH) or OCT or Optical Coherence Tomography or Optical Coherence Domain Reflectometry or OCDR or Optical Low-coherence Reflectometry or OLCR or Coherence Tomography or Coherence Domain Reflectometry or CDR or Fourier Domain OCT or FD-OCT or Spectral Domain OCT or SD-OCT or Swept Source OCT or SS-OCT or Time Domain OCT or TD-OCT or Ultrahigh-Resolution OCT or UHR-OCT)	104,106
#9	#8 AND #3	498
#10	TS=(FFA or Fundus fluorescein angiography or Fluorescein angiography or Fundus fluorescein angiogram)	25,218
#11	#10 AND #3	45
#12	TS=(CFP or Color fundus photography or Fundus photography or Color fundus imaging or CFI or Ultra-wide field color fundus photography or UWF-CFP or Retinal fundus photography)	18,068
#13	#12 AND #3	163

TS, title and subject.

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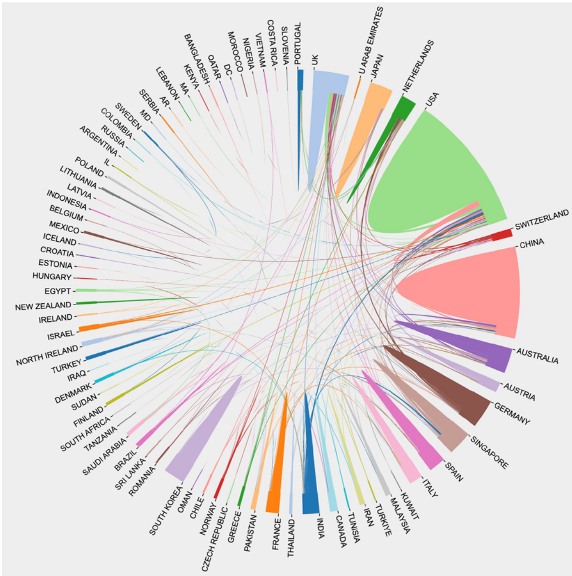

From	To	Frequency
USA	CHINA	68
USA	UNITED KINGDOM	59
USA	GERMANY	34
UNITED KINGDOM	GERMANY	30
USA	AUSTRALIA	30
CHINA	AUSTRALIA	28
USA	SINGAPORE	28
USA	SWITZERLAND	28
USA	INDIA	27
GERMANY	NETHERLANDS	26
GERMANY	SWITZERLAND	25
UNITED KINGDOM	SWITZERLAND	25

Figure S1 The examination of global collaborations in the context of AI in AMD involves assessing the frequency of collaborative efforts among nations. AI, artificial intelligence; AMD, age-related macular degeneration.

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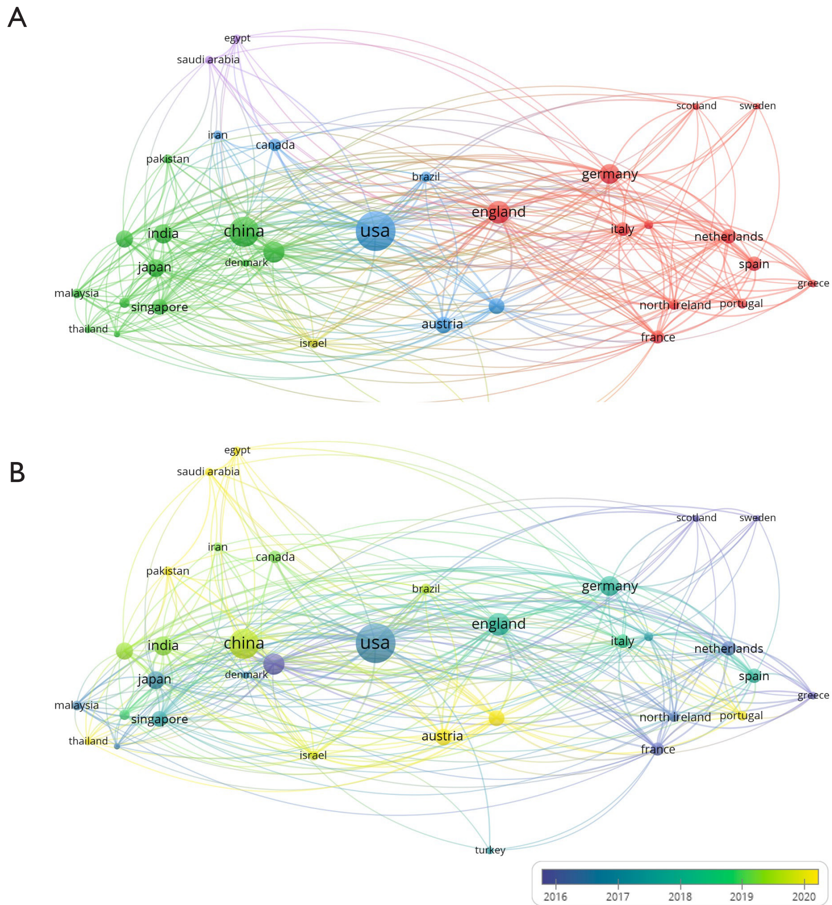

Figure S2 Graphical representation of country/region co-authorship analysis. (A) Clustering network; (B) time-overlapping network.

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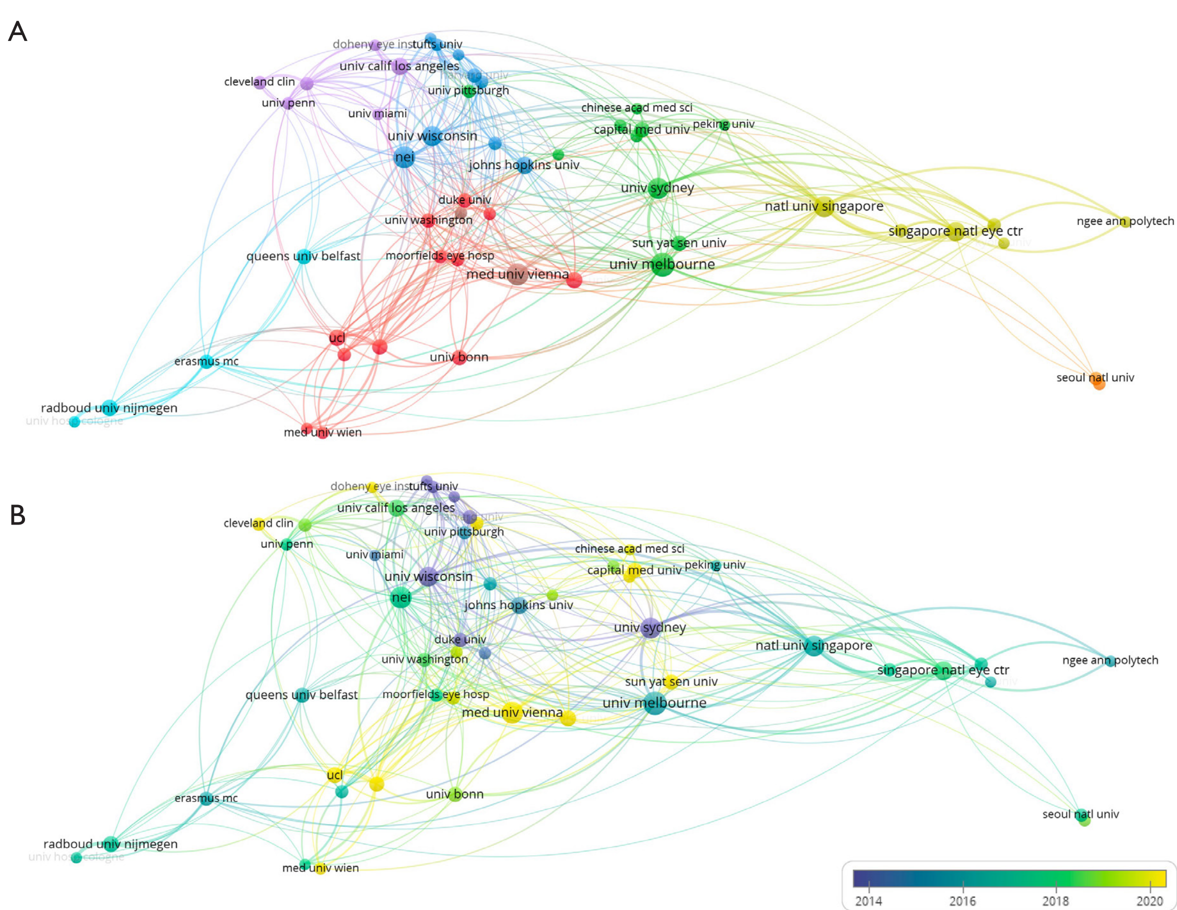

Figure S3 Visualization of institutional co-authorship analysis. (A) Clustering network; (B) time-overlapping network.

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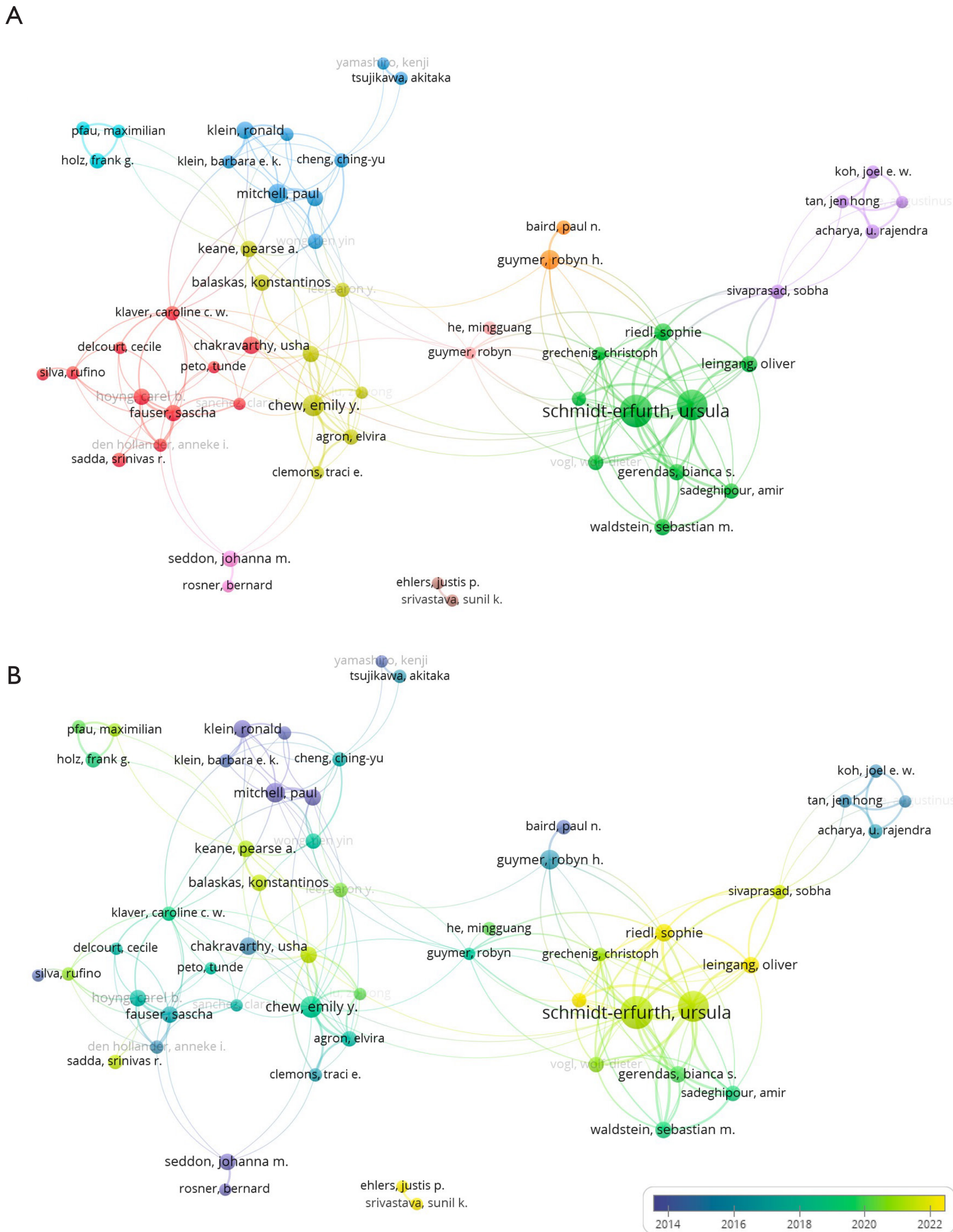

Figure S4 Visualization of researcher co-authorship analysis. (A) Clustering network; (B) time-overlapping network.

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Table S2 The top 10 cited articles

Rank	Title	Year, Journal	First author	Total citations	TC per Year
1	A randomized, placebo-controlled, clinical trial of high-dose supplementation with vitamins C and E, beta carotene, and zinc for age-related macular degeneration and vision loss - AREDS Report No. 8	2001, *Archives of ophthalmology*	Kassoff, A	2,277	71
2	Identifying Medical Diagnoses and Treatable Diseases by Image-Based Deep Learning	2018, *Cell*	Kermany, DS	1,686	53
3	Development and Validation of a Deep Learning System for Diabetic Retinopathy and Related Eye Diseases Using Retinal Images from Multiethnic Populations with Diabetes	2017, *JAMA*	Ting, DSW	1,179	37
4	Dietary carotenoids, vitamin-a, vitamin-c, and vitamin-e, and advanced age-related macular degeneration	1994, *JAMA*	SEDDON, JM	1,130	35
5	Artificial intelligence and deep learning in ophthalmology	2019, *British Journal of Ophthalmology*	Ting, DSW	587	18
6	Retinal image analysis: Concepts, applications and potential	2006, *Progress in Retinal and Eye Research*	Patton, N	445	14
7	Efficacy of a Deep Learning System for Detecting Glaucomatous Optic Neuropathy Based on Color Fundus Photographs	2018, *Ophthalmology*	Li, ZX	421	13
8	Automatic segmentation of nine retinal layer boundaries in OCT images of non-exudative AMD patients using deep learning and graph search	2017, *Biomedical Optics Express*	Fang, LY	370	12
9	Automated Grading of Age-Related Macular Degeneration from Color Fundus Images Using Deep Convolutional Neural Networks	2017, *Jama Ophthalmology*	Burlina, PM	367	11
10	A randomized, placebo-controlled, clinical trial of high-dose supplementation with vitamins C and E and beta carotene for age-related cataract and vision loss - AREDS Report No. 9	2001, *Archives of Ophthalmology*	Kassoff, A	353	11

TC, total citations.

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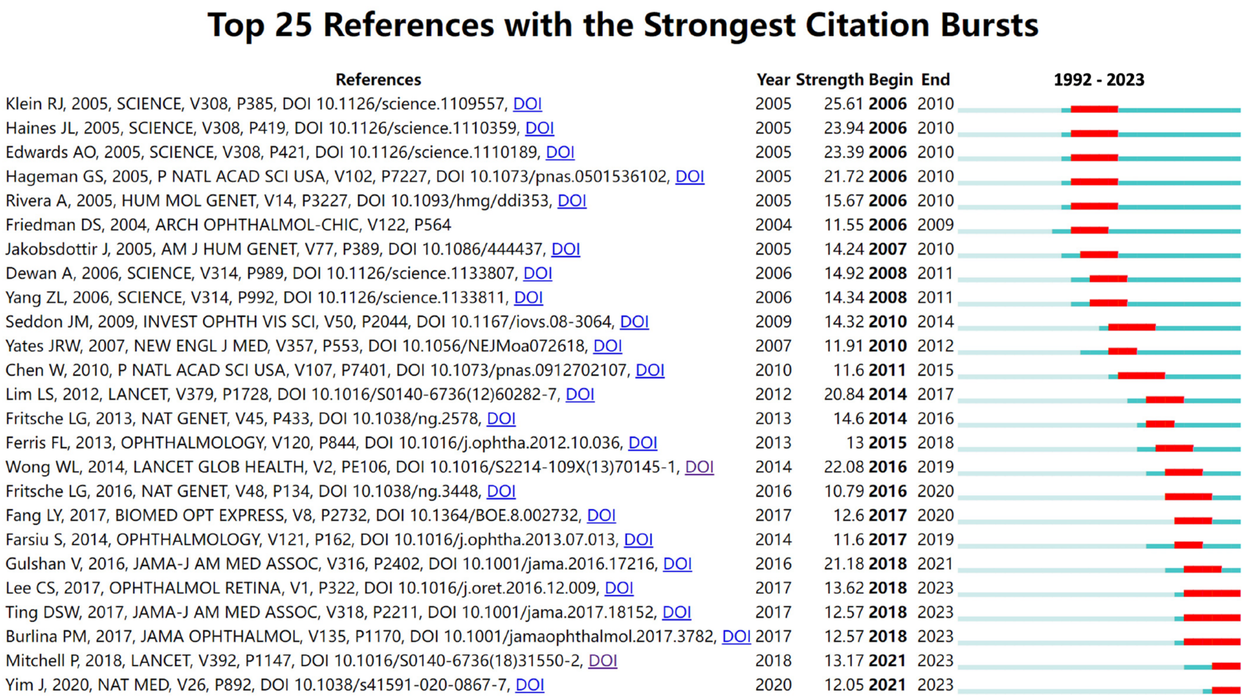

Figure S5 Top 25 most frequently cited references in the field of AI in AMD. AI, artificial intelligence; AMD, age-related macular degeneration.

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Table S3 Stages of AI research in AMD

Stage	Keywords	Key achievements	AI technologies
Risk factor analysis (1992–2005	Risk factors, smoking, cardiovascular disease	• Identification of modifiable and non-modifiable risk factors associated with AMD incidence and progression • Development of models for predicting AMD risk based on these factors	Logistic regression
Genetic exploring and mechanism understanding (2005–2015)	Genetic polymorphisms, complement factor-H, C-reactive protein	• Discovery of genetic variants associated with AMD susceptibility through genome-wide association studies (GWAS) • Elucidation of the role of genetic mutations in AMD pathogenesis	Various AI technologies used in GWAS, such as machine learning, dimensionality reduction techniques, feature selection methods and ensemble methods
Deep learning and image analysis (2015–present)	Deep learning, feature extraction, segmentation, OCT	• Development of deep learning algorithms that can extract information from OCT images and fundus photography • Development of AI systems for AMD diagnosis, severity assessment, and progression prediction	Deep learning (esp. CNNs), transfer learning

AI, artificial intelligence; AMD, age-related macular degeneration; OCT, optical coherence tomography; CNN, convolutional neural network.

Table S4 Research frontiers and future directions

Aspects	Details
Improvements of healthcare	• Disease risk stratification • Treatment efficacy prediction • Interpretable modeling to identify underlying mechanisms of AMD and potential therapeutic targets
Improvements of AI systems	• Validation and refinement of AI models on larger and diverse datasets • Enhancing the interpretability and reliability of AI models • Long-term monitoring and evaluation of AI systems in real-world clinical settings
Other choices of AI architectures	• Application of LLMs in image processing or multimodal data integration • Application of VLMs in multimodal data integration

AI, artificial intelligence; AMD, age-related macular degeneration; LLM, large language model; VLM, vision-language model.

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