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Technological Patent Mapping of Software Applied to Autism Spectrum Disorder

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Abstract
The development of software targeting Autism Spectrum Disorder (ASD) has grown significantly in recent decades, driven by advances in digital technologies and artificial intelligence. Patent registration in this field constitutes an important indicator of technological trends and the actors involved in innovation. This study aims to map the landscape of international patents related to software applied to ASD through a patentometric analysis. The search was conducted in the Espacenet database using the descriptors "software" AND "autism", resulting in 47 patent documents published between 2007 and 2026. The results show progressive growth in filings from the 2010s, with significant acceleration between 2020 and 2023. China and the United States lead production, accounting for 76.59% of the identified patents. The predominant technological classifications are associated with biomedical measurement systems (A61B5), health informatics (G16H), and educational technologies (G09B). The profile of applicants indicates a relatively balanced participation among companies, universities, and health institutions. It is concluded that the field presents relevant technological dynamism, with a predominance of solutions focused on diagnostic support and behavioral intervention, although the clinical and regulatory maturity of these technologies requires further investigation.
Keywords: *autism, patents, health software, technological mapping, artificial intelligence*

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I. Introduction

Autism Spectrum Disorder (ASD) is a neurodevelopmental condition characterized by variations in social communication, behavioral patterns, and sensory processing (American Psychiatric Association [APA], 2022). Global estimates indicate that approximately 1 in every 100 children presents some form of ASD, representing a significant challenge for health, education, and social assistance systems worldwide (World Health Organization [WHO], 2023).

Early identification and timely intervention have been consistently identified as determining factors for better developmental outcomes in people with ASD (Zwaigenbaum et al., 2015; Lord et al., 2020). However, access to specialized professionals, validated diagnostic instruments, and quality intervention programs remains unequal, especially in low- and middle-income countries (WHO, 2023).

In this context, the development of software and digital platforms oriented toward ASD has emerged as a relevant complementary strategy, aiming to expand access to screening tools, diagnostic support, behavioral intervention, and caregiver training. These solutions use resources such as artificial intelligence, machine learning, virtual reality, motion analysis, and natural language processing to offer functionalities previously restricted to specialized clinical settings (Kientz et al., 2013; Abbas et al., 2020).

Patent mapping is a well-established methodology for understanding the state of the art and innovation trends in a given technological field. Through patentometric analysis, it is possible to identify the main inventors, applicants, producing countries, and predominant technological classifications, offering a perspective complementary to that provided by the bibliometrics of scientific articles (Lanjouw & Schankerman, 2004; World Intellectual Property Organization [WIPO], 2023).

Given this scenario, the present study seeks to contribute to the understanding of the technological innovation ecosystem focused on ASD, through the mapping of patents registered in the Espacenet database using the descriptors "software" AND "autism".

Objective

To map the landscape of international patents related to software applied to Autism Spectrum Disorder.

II. Method

This is a patentometric study with a quantitative and descriptive approach, developed from secondary data extracted from the Espacenet patent database, maintained by the European Patent Office (EPO). The study's time frame covers the period from 2007 to 2026, enabling the analysis of the historical evolution of patent filings over approximately two decades.

The Espacenet database was selected for its broad international coverage, including documents from more than 100 patent offices, and for its advanced search interface that allows access to detailed metadata for each patent document. The methodological procedure began with the insertion of the descriptors "software" AND "autism" in the title and abstract search fields, resulting in an initial universe of 47 patent documents.

The obtained records were exported in Excel format, containing information on title, publication number, publication date, inventors, applicants, international patent classification (IPC), and cooperative patent classification (CPC). Data analysis considered patentometric indicators, including the temporal evolution of filings, the geographic distribution of production, predominant technological classifications, the profile of applicants, and thematic trends related to the use of software in the context of ASD.

It should be noted that the search strategy adopted — with the descriptors "software" AND "autism" restricted to title and abstract — was defined with the objective of identifying patents with explicit and direct focus on the application of software to ASD, avoiding the retrieval of documents with peripheral mention of the topic. It is recognized that this delimitation results in a relatively small sample (N = 47), which is inherent to the specificity of the adopted approach and does not compromise the validity of the mapping conducted. The choice to restrict the search to Espacenet is justified by its broad multi-country coverage and the standardization of exported metadata, which allowed systematic and comparable analysis among documents from different jurisdictions.

III. Results

The patentometric analysis of the 47 patents identified in the Espacenet database revealed progressive growth in filings throughout the analyzed period (2007–2026), with more pronounced intensification from the 2020s. This temporal pattern reflects the advancement of digital technologies applied to health and education, especially those based on artificial intelligence and computational processing of behavioral data. Table 1 presents the annual distribution of patents in absolute, percentage, and cumulative terms.

Table 1

Annual Distribution of Patents on Software Applied to ASD in the Espacenet Database (2007–2026)

Year	N Patents	% of Total	Cumulative %
2007	1	2.13%	2.13%
2008	1	2.13%	4.26%
2009	1	2.13%	6.38%
2011	1	2.13%	8.51%
2012	3	6.38%	14.89%
2014	2	4.26%	19.15%
2015	3	6.38%	25.53%
2016	1	2.13%	27.66%
2017	2	4.26%	31.91%
2018	3	6.38%	38.30%
2019	3	6.38%	44.68%
2020	4	8.51%	53.19%
2021	3	6.38%	59.57%
2022	5	10.64%	70.21%
2023	5	10.64%	80.85%

2024	3	6.38%	87.23%
2025	4	8.51%	95.74%
2026	2	4.26%	**100.00%**
Total	**47**	**100.00%**	—

Note. N = 47 (total sample). Source: Espacenet database, 2026.

The temporal distribution shows that filings were scarce until 2011, with only three patents recorded in 2007, 2008, and 2009. From 2012, gradual growth began, followed by significant acceleration between 2020 and 2023, a period that concentrates 38.30% of all identified production. The years 2022 and 2023 alone account for 21.28% of the total, reflecting the significant advancement of digital technologies applied to mental health and neurodevelopment during this period.

Figure 1 visually illustrates this distribution, highlighting the acceleration of the growth curve from 2020 and the resumption of growth in 2025–2026, indicating that the field remains in expansion at the current moment of the research.

Figure 1

Temporal evolution of patent filings on software applied to ASD (2007–2026): absolute N and relative percentage.

Note. Left axis: absolute number of patents (bars). Right axis: percentage relative to total sample (line). Source: Espacenet database, 2026.

Regarding geographic distribution, the results reveal marked concentration of production in two countries: China (21 patents; 44.68%) and the United States (15 patents; 31.91%), which together account for 76.59% of the total. Patents of international scope, filed via PCT with the World Intellectual Property Organization (WIPO), total four documents (8.51%). Table 2 presents the complete distribution by country or region of origin.

Table 2

Geographic Distribution of Patents on Software Applied to ASD (2007–2026)

Country/Region	N Patents	% of Total
China	21	44.68%
United States	15	31.91%
PCT (International)	4	8.51%
South Korea	2	4.26%
Japan	1	2.13%
Taiwan	1	2.13%
Luxembourg	1	2.13%
Mexico	1	2.13%
Russia	1	2.13%
Total	**47**	**100.00%**

Note. Source: Espacenet database, 2026.

Figure 2

Geographic distribution of patents on software applied to ASD — filing countries and regions.

Source: Espacenet database, 2026.

The analysis of technological classifications, considering both the International Patent Classification (IPC) and the Cooperative Patent Classification (CPC), revealed a predominance of codes associated with biomedical measurement and monitoring systems. Class A61B5 (measurements for diagnostic purposes) presented the highest frequency, with 22 occurrences in the IPC and 91 subcategories in the CPC, evidencing the centrality of physiological and behavioral data acquisition and analysis technologies in the field. In second place, G16H codes (health informatics) stand out, with 8 IPC occurrences, indicating a focus on information systems and clinical decision support platforms. Codes G09B (teaching/training devices and systems) and G09B19 (educational methods) appear with 7 and 5 occurrences, respectively, signaling the relevance of technological solutions aimed at educational and behavioral intervention.

Figure 3 presents the distribution of the ten most frequent international classifications in the analyzed corpus.

Figure 3
Ten most frequent IPC technological classifications in patents on software applied to ASD.
Source: Espacenet database, 2026.

Regarding the profile of applicants, the analysis identified three main categories: private companies (19 patents; 40.43%), universities and research institutes (14 patents; 29.79%), and hospitals or health institutions (9 patents; 19.15%). The remaining filings were made by individual inventors. This profile indicates a relatively balanced distribution among institutional actors, with slight predominance of the private sector, suggesting that the field presents both commercial dynamism and academic and clinical relevance.

Figure 4
Distribution of patents on software applied to ASD by applicant profile.
Source: Espacenet database, 2026.

The analysis of inventors' countries of origin revealed a distribution distinct from that observed in filing countries. The United States leads with 29 identified inventors (50.9% of total occurrences), followed by China (11; 19.3%) and Switzerland (7; 12.3%), reflecting the presence of major pharmaceutical and health technology groups with research centers based in that country. Germany (6; 10.5%) and South Korea (3; 5.3%) complete the five countries with the highest inventor representation. There is therefore an asymmetry between the country of filing and the country of origin of inventors: although China leads in number of patents filed, American inventors are proportionally more numerous, suggesting that part of the innovation registered by Chinese institutions may involve international collaborations or knowledge transfers among teams of different nationalities.

The analysis of the titles and abstracts of the identified patents allowed mapping of the main thematic categories of the developed technological solutions. These include: (1) tracking and diagnostic systems based on motor behavior, facial expression, and language pattern analysis; (2) behavioral intervention and training platforms using virtual reality and interactive games; (3) continuous monitoring systems with wearable devices; (4) biological and genomic data analysis tools; and (5) applications to support communication and social interaction. This thematic diversity reflects the breadth of possible applications of digital technologies in the context of ASD.

IV. Discussion

The results of this patentometric study show that the field of technological innovation focused on ASD is in full expansion, with progressive growth in patent filings, especially from 2020. This finding is consistent with broader trends observed in the global digital health innovation ecosystem, in which the development of solutions based on artificial intelligence, machine learning, and data analysis technologies has advanced at an accelerated pace (Topol, 2019; WHO, 2021).

The leadership of China and the United States in the production of patents on software applied to ASD reflects the position of these countries as the main hubs of investment in research, development, and technological innovation at the global level. In the case of China, the significant growth observed from 2018 accompanies national policies to stimulate innovation in digital health and artificial intelligence, consolidated in the context of the strategic plan "China Standards 2035" and sectoral initiatives aimed at modernizing the healthcare system (Roberts et al., 2021). In the United States, the tradition of intellectual property protection and the robust ecosystem of digital health startups contribute to maintaining a leadership position in the field (WIPO, 2023).

The absence of patents from Brazil, Latin America, and African countries represents a significant gap. Of the nine countries or regions identified in the corpus, seven are high-income economies, and only Mexico figures as a representative of a middle-income country — with just one patent (2.13%). This scenario reflects both the insufficiency of policies to encourage technological innovation in these regions and the structural inequalities in access to research and development resources. This is especially concerning considering that the majority of the world's population with ASD resides precisely in these contexts, where access to specialized services is most restricted (WHO, 2023; Durkin et al., 2015).

The predominance of classifications associated with biomedical measurement (A61B5) and health informatics (G16H) indicates that the identified patents are concentrated in solutions supporting diagnosis and clinical monitoring, reinforcing the perception that technological innovation has been primarily oriented toward the identification and assessment of ASD, and to a lesser extent toward intervention, rehabilitation, and support for autonomy phases. This tendency aligns with discussions about the risk of overestimating the role of technologies in diagnosis, at the expense of broader support approaches throughout the life cycle of people with ASD (Lord et al., 2020).

The balanced participation of companies (19 patents; 40.43%), universities and research institutes (14; 29.79%), and health institutions (9; 19.15%) in the applicant profile suggests that the field has relevant collaborative dynamics, with contributions from both the academic and productive sectors. It is relevant to note that all patents filed by private companies come from developed countries, predominantly the United States and China, which reinforces the perception that access to technological innovations in the context of ASD remains

geographically concentrated. However, the predominance of solutions patented by large corporations may signal risks of market concentration and limitations of access to innovations in low-income contexts (Lanjouw & Schankerman, 2004).

From an ethical standpoint, the advancement of tracking and diagnostic technologies based on artificial intelligence for populations with ASD raises relevant questions about data privacy, algorithmic bias, informed consent, and the impact on the identity and autonomy of autistic people (Floridi et al., 2018; WHO, 2021).

Critical literature on artificial intelligence in healthcare has warned of the risks of perpetuating inequalities and reducing complex living conditions to quantifiable patterns, especially when the affected populations do not participate in the development processes of these technologies (Obermeyer & Emanuel, 2016).

Finally, it should be noted that patentometric analysis, although constituting a complementary and valuable methodology for mapping technological innovation, has inherent limitations. The total number of patents identified (47) is relatively small, which may reflect both the emerging nature of the field and the intellectual protection strategies adopted, which do not always include formal patent registration for software in all jurisdictions. Furthermore, the analysis is restricted to the Espacenet universe, not covering documents registered exclusively in national databases not indexed by this platform.

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