The Role of Artificial Intelligence in Nutritional Research

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Abstract   Artificial intelligence (AI) as a department of pc science, the cause of that is to mimic idea processes, gaining knowledge of capabilities and understanding management, is more and more being utilized in experimental and medical medicine. In the biomedical sciences, the opportunities of synthetic intelligence withinside the subject of scientific diagnosis, threat prediction and aid of healing strategies are developing rapidly. The purpose of the thing is to investigate the modern-day use of AI in dietary studies. PubMed gathered a complete of 399 facts units posted among 1 and 2020, of which 261 have been rejected after reading the titles and abstracts; In the subsequent steps, the ultimate information have been analyzed the usage of the full-textual content variations and sooner or later fifty five articles have been divided into 3 areas: IA in biomedical nutrient studies (20 research), IA in medical studies vitamins (22 research) and KI in dietary epidemiology (thirteen research), wherein the synthetic neural community (ANN) approach became proven to be dominant. withinside the meals composition studies group. However, device gaining knowledge of (ML) algorithms had been extensively utilized in research of the have an impact on of vitamins at the functioning of the human frame in fitness and disease, in addition to in research of the intestine microbiota. Clinical Nutrient Uptake Research Group. The improvement of dietary structures with AI generation can cause the advent of a worldwide community this is capable of actively aid and screen customized nutrient intake.

Keywords: synthetic intelligence; synthetic neural networks; device gaining knowledge of; Nutrient Search

1. INTRODUCTION

The term "artificial intelligence" turned into first proposed in 1955 through the American pc scientist John McCarthy (1927–2011) withinside the idea of a studies project, which turned into carried out the subsequent yr. at Dartmouth College in Hanover, New Hampshire [1,2]. Artificial intelligence (AI) as a department of pc science, the reason of that's to imitate concept processes, mastering competencies and information management, reveals extra and extra packages in experimental and scientific remedy. In current decades, there has been a growth of AI packages in remedy and biomedical sciences. The possibilities of synthetic intelligence withinside the discipline of clinical diagnostics, threat prediction and assist of healing strategies are developing rapidly. Thanks to using AI in ophthalmological [3], radiological [4] and cardiac [5] diagnostics, measurable scientific advantages were obtained. AI turned into utilized in studies on new pharmaceuticals [6]. The improvement of AI additionally provides new possibilities for studies on vitamins and clinical sensing technology [7].

1.1 Artificial Neural Networks (ANNs)

ANNs as a presently extensively used modeling method withinside the subject of AI has been inspired with the aid of using the shape of herbal neurons of the human brain. ANNs are mathematical fashions designed to system and calculate enter indicators via rows of processing elements, called synthetic neurons, linked to every different with the aid of using synthetic synapses. There are 3 types of layers forming ANNs. The enter layer captures the uncooked information and passes them to the hidden layer. In this 2d layer, the studying system takes place. The outcomes of the evaluation are accrued withinside the output layer and the output information are created. A neural network might also additionally include masses of unmarried units. An ANN is a parameterized gadget that has weights as adjustable parameters. Due to the want for estimation of

those parameters, ANNs require massive education sets. ANNs accumulate expertise with the aid of using detecting styles and relationships among information, i.e., via experience, now no longer because of programming. An ANN famous its precise usefulness withinside the case of the want for modeling datasets with non-linear dependencies. In fixing biomedical problems, uncooked information may be each literature and experimental information. In the final decades, ANNs were used, among others, to create an experimental choice set of rules version open to improvement, aimed at comparing the outcomes of biochemical assessments faced with each reference values and medical information. This method become extensively utilized in assessment of molecular lifestyle cross-contamination ranges primarily based totally on mass spectrometric fingerprints of intact mammalian cells [9]. The precise usefulness of ANNs has been validated in pharmaceutical analyses [10]. An interesting software of ANNs is the prediction of the connection among the Mediterranean dietary pattern, medical traits and cognitive functions [11]. The usefulness of ANNs has been validated in frame composition analyses, that have definitely non-linear traits [12]. Using ANN modeling, huge advantages may be received in medical dietetics. It is really well worth noting that the bushy commonsense methodology (FLM) may be blended with neural networks. The concept of this place of AI is to attempt for more accuracy, dimensionality and simplification of the shape. There is an opportunity to create fuzzy neural networks and convert FLM-primarily based totally fashions into neural networks.

1.2 Machine Learning (ML)   ML is a place of AI that pertains to algorithms that robotically enhance via experience. ML algorithms have the capacity to create mathematical fashions for choice making. The system of making those fashions is primarily based totally on massive education records units, no programming. The popularization of using ML algorithms befell in seek engine programs withinside the final decade of the 20th century. In the many years that followed, there have been excessive hopes for principal discoveries withinside the discipline of natural synthesis the usage of an increasing number of superior ML algorithms [13]. While those hopes have now no longer been completely fulfilled, this place of AI has vital programs in each biomedical sciences and tilt medicine. Machine learning, each supervised and unsupervised, may be implemented to medical records units to broaden threat fashions [14]. assist the evaluation of affected person records [15].

1.3. Internet of Things (IoT) The time period IoT changed into first utilized by British entrepreneur and startup founder Kevin Ashton in 1999, withinside the feel of a community of related objects. This is the idea that objects (devices) can immediately or not directly collect, method or trade records thru a laptop community or sensible electric installation. The time period Internet of Everything (IoE) is used to describe a community of people, processes, records and matters related to the Internet. In scientific medicine, IoT has a sizable utility with regards to telemedicine procedures, which might be turning into increasingly more broadly used, specifically throughout the COVID-19 pandemic. Important programs of IoT also can be visible withinside the provision of distinctive records on meals merchandise to be had at the market.

2. Materials and Methods

The goal of the object is to research the modern-day use of AI in vitamins technology studies and to decide the potentialities of its similarly utility on this area. The literature overview turned into carried out in PubMed the use of an aggregate of searching terms: "synthetic intelligence" (All Fields) AND "vitamins" (All Fields). A general of 399 facts (posted among 1987 and 2020) had been obtained, of which, after studying the title and abstracts, 261 had been rejected. In the subsequent stage, the final facts had been analyzed the use of the full-textual content variations and 111 papers had been selected. These papers had been afterwards divided into 4 categories: AI in agricultural vitamins studies, AI in biomedical, AI in medical vitamins studies and AI in dietary epidemiology. In order to restriction the analyzed troubles to biomedical aspects, agricultural and environmental vitamins studies turned into excluded (Figure 1).
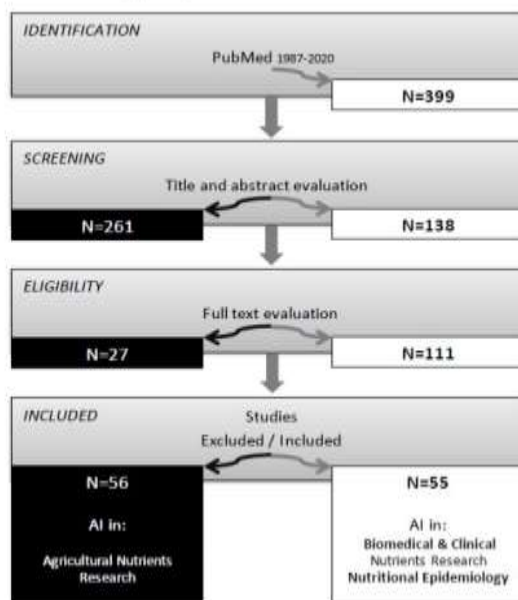
Figure 1. Methodological flowchart of papers reviewed

3. Results

3.1. AI in Biomedical Nutrients Research

In the place of biomedical vitamins studies, there had been recognized research in which superior AI strategies and structures had been carried out when it comes to the have a look at of the composition of meals products, optimization of nutrient production, the consequences of vitamins at the functioning of the human frame in fitness and ailment and studies at the intestine microbiota (Table 1).

Table 1. The characteristics of the included studies on biomedical nutrients research.

Topic	Number Of Studies [Ref]	Nutrients	Domains	Algorithms	Years
Food composition	6 [23-28]	Proteins, Minerals (K, Ca, Mg), Trace elements	ANN, ML	SVM, LS-SVM, SVR, GA-RBFN, PLS, GA-PLS, KohNN, LASSO, CLAs	1996,2013,2016,2017, 2019
Production of nutrients	3 [29-31]	Retinol, Benzoquinones, Phycobiliproteins	ANN, FLM	LM, GA, ANN-GAR, FFD, GA-Fuzzy	2017,2020
Influence of nutrients on phys./path. Functions	8 [32-39]	Proteins, Vitamins (A, B, C, D, K)	ANN, FLM, ML	SVM, BN, NB, RF, CLAs	2013,2014,2016,2018, 2019
Gut microbiota	3 [40-42]	Nutrients from food	ML, NV	SVM, , RF, CLAs	2015,2017,2019

Total	20				1996-2020

Note: Domains: ANN = artificial neural network, ML = machine learning, FLM = fuzzy logic methodology, NV = network visualization; learning algorithms: kNN = k-nearest neighbor, KohNN = Kohonen neural network, LM = Levenberg–Marquardt algorithm, GA = genetic algorithm, ANN-GAR = Garson's algorithm, GA-Fuzzy = fuzzy genetic algorithm, FFD = fractional factorial design, LASSO = least absolute shrinkage and selection operator, GA-PLS = genetic algorithm-partial least squares, PLS = partial least squares regression, GA-RBFN = genetic algorithm-radial basis function network, LS-SVM = least squares support vector machine, SVM = support vector machine, SVR = support vector regression, BN = Bayes net, NB = naive Bayes, RF = random forest, CLAs = clustering algorithms .

According to graphical traits of the analyzed works (Figure 2), the ANN method ruled each in meals composition have a look at and the manufacturing of vitamins. Among the works at the have an effect on of vitamins at the functioning of the human frame in fitness and ailment and research at the intestine microbiota, ML area algorithms had been used nearly exclusively. The fuzzy good judgment method changed into used occasionally.

3.1.1. AI's food composition research

It uses artificial intelligence technology to analyze the composition of food and verify its originality. Its history can be traced back to the 1990s. Detma et al. Using ANN technology, fetal disease neighborhoods were identified from 16 variables representing orange juice samples. The efficiency of the prefab calculation method has been changed to 92.5%. Regel et al. Isobaric labeling for relative and absolute quantification A proteomics method for studying the differently expressed whey proteins in human and bovine colostrum and mature milk to capture the same type of serum proteome. It may also provide useful information about this incident. Nutritious baby food and agricultural products. Morella et al. In, the method of evaluating and training cashew nut samples that are difficult to understand uses the topological map of Kohonen neural network. Shen et al. used laser-induced breakdown spectroscopy (LIBS), useful resource vector machine statistical method (LSSVM) and LASSO model to detect six kinds of Panax not ginseng (Chinese medicine) samples from eight production bases Nutrients]. ... Rasuli and others. Complete genetic positioning algorithm , radial basic operation network method (wsGARBFN) to clarify the content of trace minerals Fe2+, Zn2+, Co2+ and Cu2+ in various samples of medicine and vegetable products (tomatoes, lettuce, cabbage) And Brussels sprouts) The research organization also includes the analysis of Soltani et al. 3 I actually thought of one of the quantitative models Bitter Style Ratio (QSBR) (artificial neural network, multiple linear regression and useful resource vector machine) to guess the bitterness of 229 peptides.

3.1.2. Artificial Intelligence in Food Production Analysis

Regarding research on to improve certain food ingredients, there are many studies using artificial intelligence models. Huang et al. They used artificial neural networks (ANN) to force the production of an anti-eye drug derivative called Retinyl Laurate. Zheng et al. The optimization of and the production of 2,6-dimethoxybenzoquinone (DMBQ) and methoxy-benzoquinone (MBQ) were studied, which can induce malignant formation of bitter wheat germ. Algorithm (GA). The ANN model and Levenberg-Marquardt algorithm learning rules are used to simulate the complex non-linear interaction between 16 nutrients in the manufacturing process. Kumar et al. Use GA-Fuzzy, an organic processing algorithm composed of genetic algorithm (GA) and symbolic logic method (FLM) to improve the structure of eubacterial phycobiliprotein (PBP). Avoid combining SI and CGS units, such as current in amperes and magnetic field in oersted's. This often leads to confusion because equations do not balance dimensionally. If you must use mixed units, clearly state the units for each quantity that you use in an equation.

3.1.3 AI within the analysis on the consequences of nutrients on physiological and pathophysiological functions.

It represents the biggest cluster of papers employed by computer science models in nutrient medical specialty research. calories are sustenance research. Pavagne et al. The psychological disorder model was wont to study the effects of antihemorrhagic factor (K1, K2, and K3) changes on the regulation of decoagulant dose needs. The AI model is employed to predict the dose of warfarin. during this study, an increase in antihemorrhagic factor within the CYP4F2 V433M polymorphism was observed. the appliance of computer science technology in the study of the consequences of calciferol on human perform delineate in a piece of writing printed in 2019. Yu et al. The expression profiles of miRNA, lncRNA, informational RNA and circRNA between epithelial tissue root cells (EPC) treated with 1,25 (OH) 2D3 and management cells were compared. They used bioinformatics analysis to spot differentially expressed RNA, and used Cytoscape code to construct polymer

competitive epithelial tissue networks (ceRNA). Zhang et al. The PPI network was wont to study the impact of 1.25 dihydroxy calciferol3 (1.25(OH)2D3) on primary chondrocytes civilized from patients with protein-protein interaction (PPI) arthritis. They prompt that their analysis will give a theoretical basis for the utilization of vitamin D in the treatment of osteoarthritis. Chapter makes an attempt to check the hypothesis that water-soluble vitamin mediates the proliferation and differentiation of bone marrow stromal cells through regulation of miRNA. They conducted bioinformatics analysis to spot new target sequences and sign pathways. Use Wordle on-line code to form gene metaphysics word clouds. Huang et al. They used RNASeq and bioinformatics analysis to check the impact of the active ingredients of licorice (Glycyrrhiza glabra) on muscle fatigue. They use machine learning models and accent tools to predict drugs. They known hispaglabridin B (HB) as a potential FoxO1 inhibitor, which may be wont to forestall muscle atrophy in chronic nephrosis. Chapter studies the role and mechanism of maidenhair tree in Alzheimer' disease. uses the combined target disease and combined cluster target pathway (CGTP) network model. Panwar et al. pc models are developed to predict the residues that move with sustenance supported the first structure of the protein. They used machine learning techniques cherish totally different classifiers from SVM, Random Forest, BayesNet, Naive Bayes, Naive Bayes Multinomial and Complement Naive Bayes, and also the perform of Position marking Matrix (PSSM). macromolecule sequence want to determine residues in proteins that move with vitamins.

3.1.4. AI in analysis on Gut Microbiota

In latest years, effects of studies on vitamins and also the viscus microbiota the utilization of AI ways had been published. Devika and Raman used genome-scale metabolic fashions to differentiate among thirty-six very important Bifidobacterial traces. Shima et al. done analyses concerning the intestine microbiota, wholly} totally on a combination of system gaining data of and community visual image. MA hound and Guda used AI withinside the studies on enzymes made with the help of exploitation traces of intestine bacterium. They evolved ECemble, a technique to discover proteins and observe the human viscus metabolic pathways. ECemble makes use of an ensemble of system gaining data of strategies to expect and find out the enzyme classes. They recognized forty-eight pathways that have a minimum of one bacteria-encoded enzyme and are involved in metabolizing vitamins.

3.2. AI in Clinical Nutrients analysis

The far side research withinside the realm of scientific vitamins studies, AI ways had been used in tasks double-geared toward growing gear serving to organic process sports and in supplementation, additionally to withinside the analysis and prediction of the threat of continual diseases (Table 2).

Table 2. The characteristics of the included studies on clinical nutrients research.

Topic	Number of studies [Ref]	Nutrients	Domains	Algorithms	Years
Clinical Nutrients Intake	11 [43-53]	Carbohydrate, Lactose, Protein, Minerals	ML, DL, FLM	LASSO, FFNN, SVM, kNN	2003, 2008, 2015, 2017-2019
Diseases risks to food and nutrients patterns	4 [54-57]	Carbohydrate, Triglyceride, Micronutrients (Folate, B12)	ANN, ML	kNN, DTA LR, RF	2016, 2018, 2020
Disease and trace elements levels	4 [58-61]	Trace elements (lithium, zinc, chromium, copper, iron, manganese)	ML	SVM, DTA, RF, NB	2009, 2012, 2014, 2017
Supplementations	3 [62-64]	Vitamins (A, C, D) Curcumin, Glycyrrhizic acid	ML	CLAs	2020
Total	22				2003-2020

Note: Domains/methods: ANN = artificial neural network, ML = machine learning, DL = deep learning, FLM = fuzzy logic methodology; learning algorithms: kNN = k-nearest neighbor, LASSO

= least absolute shrinkage and selection operator, FFNN = feed forward neural network, LR = linear regression, RF = random forest, DTA = decision tree algorithm, SVM = support vector machines, NB = naive Bayes, CLAs = clustering algorithms.

According to the graphical characteristics of the analysis work (Figure 2), DL dominates the research group using therapeutic nutrition, and the secondary application of fuzzy logic method only appeared in one study.

3.2.1 Artificial intelligence in clinical nutrition intake

Artificial intelligence research in clinical practice focuses on the development of systems that track, maintain, and support the nutrition of patients with controlled chronic diseases. Lu et al., a new artificial intelligence-based system, by simply processing to accurately estimate the nutritional intake of RGB images before and after meals. In a randomized controlled study, AI-supported diet therapy with mobile applications (n = 50) and human diet therapy (n = 50) were compared. Vasilolo et al... used an interesting technical solution in the field of AI. In the clinical problem of controlling carbohydrate intake in patients with type 1 diabetes, these authors used GoCARB as a computerized smartphone system to obtain carbohydrates. Identify the dishes on the plate. The meals prepared by GoCARB were compared with the opinions of six experienced nutritionists. It was found in that the accuracy of GoCARB's estimation of carbohydrate content was the same as that of professional nutritionists (p = 0.93). Chin et al. Different from Nutrition Data System and 40; NDSR and #41; the 24-hour self-assessment tool (ASA24) was tested with lactose. ASA24, also known as Food Diary, is a web-based tool that can realize automatic coding and self-contained 24-hour meal reminders. Collection and coding software commonly used for 24-hour reminders and menu analysis. Nine machine learning models were developed using nutrients from the ASA24 and NCC databases. This study showed that this calculation method successfully evaluated a certain nutrient NCC in the foods listed in ASA24. Rapid Automatic Bite Detection (RABID) was developed to track eating behavior, remove and process bone elements from videos. Kon stantinidis et al., 45 meals), the results show that the algorithm score is consistent with people (Cohen's kappa κ = 0.894; F1 score: 0.948). Chapter provides the knowledge system and #40; Knowledge Base & # 41; For patients with chronic kidney disease, use Web Ontology Language (OWL) and Semantic Web Rule Language (SWRL). To evaluate the system and recommend an adequate supply of products from different food groups, including n = 84 patients. found that the OWL-based CAB can accurately diagnose and test problems while still being able to share and expand the knowledge base. AI technology can also help diagnose mild dehydration. Posada Quintero and so on. Use machine learning to explore the possibility of detecting mild dehydration through autonomous responses to cognitive stress (n = 17). Stroop The overall accuracy of the self-regulation index based on electrical skin activity (EDA) and pulse rate variability (PRV) in the mild dehydration test reached 91.2%. It is worth noting that these two describe the prototype of the judgment condition. Hahn and Hoffmann suggested using an incremental learning system and #40 to create a menu; MIKASund # 41; This system requires experts to make a statement to for each of their actions. In the future, this can be automatically executed in the MIKAS database. The fuzzy algorithm was used to create NutriEduc software to properly balance the diet according to the patient's energy needs. The heuristic search algorithm is used to find a set of nutritionally acceptable indicators to balance the original diet. Baek et al. Application of mixed group nutrition consultation method based on group chronic diseases and nutrition knowledge base. Use kmeans algorithm and food and nutrition data system to group foods. Food preference data was compiled in groups. Mezgec and Koroušíc Seljak proposed a new NutriNet image recognition tool, Nition Food, which is based on a deep convolutional neural network architecture. It was tested on a collection of, out of 225,953 images (512 × 512 pixels) and found 520 differences.

3.2.2. AI in Evaluating Diseases Risks in Relations to Food and Nutrients Patterns

AI strategies conjointly appear to be useful in estimating the hazard of fitness problems frequently based at the evaluation of nutritional or supplementation patterns. Panaretos et al. used the k-nearest buddies' rule and random forests name tree to evaluate the 10-yr cardiometabolic hazard in relevancy nutrient and meals patterns, n = 3042 (2001–2002). The authors of Nutrients 2021, 13, 322 8 of sixteen the study, victimization problem evaluation, regarded elements from ingredients and nutrients, respectively, explaining fifty 4 and 65% of the general version in intake. mil strategies had been observed to be advanced in comparison with regression in fitness rating classification. Berry et al. in n = one002 twins and unrelated healthful adult's teams (PREDICT 1 study) assessed the inter-person variability of postprandial metabolic responses (triglyceride, glucose, insulin) as ability hazard elements for cardiometabolic diseases. On the concept of performed cohort research, they advanced a gadget mastering version that foreseen each glycemic (r = 0.77) and glyceride (r = 0.47) responses to meals intake. Naushad et al. advanced a carcinoma prediction version supported a synthetic neural internetwork (ANN) to analyze but micronutrients (foliate, B12) modulate condition to breast most cancers. The advanced ANN version defined 94.2% variability in breast most cancers prediction. This cluster of research conjointly consists of the thing through Shiao et al., who tested n = 106 contributors in multi-ethnic huge gut most cancers households in phrases of prognostic elements of healthful feeding (HEI index). Machine mastering validation processes had been applied,

collectively with the ensemble method, generalized regression prediction, elastic internet and leave-one-out cross-validation methods.

3.2.3.AI After finding the link between the disease and the trace level

In the report of overestimation of artificial intelligence, an article examined the degree selected chemical elements in the biological samples of patients with type 2 diabetes. Tan et al. The quality of machine learning (Adaboost) and the analysis of trace elements in hair samples were examined for the detection of cardiovascular diseases in clinical applications (n = 124). peer authors tested the blood levels of multiple elements and trace elements in patients with polygenic disorder type 2 (n = 53): lithium, zinc, chromium, copper, iron, manganese, nickel and vanadium, and compared them. Similar information from healthy people (n = 105). They used Fisher Linear Discriminant Analysis (FLDA), Support Vector Machine (SVM), and Selection Tree (DT) to analyze the data to build models. In 2014, pieces of hair/urine were printed with DM (n = 211) as the victim set and support vector machine (SVM) algorithm as a classification tool as a multi-level relationship result.

In addition to the use of artificial intelligence technology to study the relationship between the risk of polygenic disorders and trace levels, it is more noteworthy that the relationship between the risk of psychosis and the levels of macro and trace elements in Examine serum. ...Sculptor etc. samples from 114 schizophrenia patients and 114 healthy people were used, these samples were from the control group, and controlled education format. 39 kinds of macronutrients and micronutrients are studied, and the prediction accuracy of support vector machine is the highest.

3.2.4.AI in the Finding of Supplements

Li et al., In a very up-to-date report they presented the bioinformatic analysis carried out and computer experiments using a networked special medical technology to assess the properties of axerophthol} as an AntiSARSCoV2 program. The same analytical goal was achieved by the team of Chen et al., Who analyzed the potential of a completely unique combination of vitamin C, curcumin and glycyrrhizic acid (VCG Plus) against CoV infection. In addition, using network analysis, Fan et al. tried to demonstrate a molecular mechanism that delays the occurrence of psychotic symptoms in Alzheimer's disease in connection with the use of Viosterol.

3.3 Artificial Intelligence in Nutritional Epidemiology

In the dietary epidemiology field, the Nutritional Assessment System and Artificial Intelligence Best Practices, the Physical Monitoring System, and the Environmental Trace Element Monitoring System have been used to validate the research (Table 3).

Table 3. The characteristics of the included studies on nutritional epidemiology.

Topic	Number of Studies [Ref]	Nutrients	Domains	Algorithms	Years
Dietary assessment	7 [65-71]	Macronutrients	ML, DL FLM	ICP, CLAs	2008, 2011, 2018–2020
Physical monitoring systems	3 [72-74]	Macronutrients	IoT, ML, DL FLM	kNN, SVM, BDLN	2008, 2011, 2018–2020
Environmental trace elements monitoring system	3 [75-77]	Trace Elements	ANN, ML	PNN, KohNN, PLS	2009, 2017, 2020
Total	13				2008–2020

Note: Domains/methods: ANN = artificial neural network, ML = machine learning, DL = deep learning, FLM = fuzzy logic methodology, IoT = Internet of Things; learning algorithms: ICP = iterative closest point algorithm, CLAs = clustering algorithms, kNN = k-nearest neighbor, SVM = support vector machine, BDLN = Bayesian deep learning network, PNN = probabilistic neural network, KohNN = Kohonen neural network, PLS = partial least squares regression.

3.3.1 Artificial Intelligence in Nutrition Assessment

Mobile applications supported by artificial intelligence are essential for nutrition prevention (Table 3). In 2008, Sun et al. It is recommended to use the electronic photography method and related image processing algorithms to estimate the amount of food. Lu et al. In a recent publication, goFOODTM is recommended as a nutritional scoring system based on AI. The calorie and macronutrient content of food can be estimated from food photos taken with a smartphone. ...

3.3.2. AI in Physical watching Systems

AI techniques have found their application not solely in monitoring the standard and amount of nutrients, however additionally in terms of the amount of their expenditure. within the face of the fat epidemic, these AI applications are terribly important. Monogaran et al. delineated the employment of a monitoring system as a good identification tool of physical activities by a wearable smart-log patch with web of Things (IoT) sensors.

3.3.3 Artificial Intelligence in the Environmental Search System

Novic Grosel employees worked out a strategy for designated nutrition with the help of RNA. The method was tested on honey samples collected as part of the TRACE UE project. In, knowledge from different regions of Europe was collected and trace element levels were analyzed.
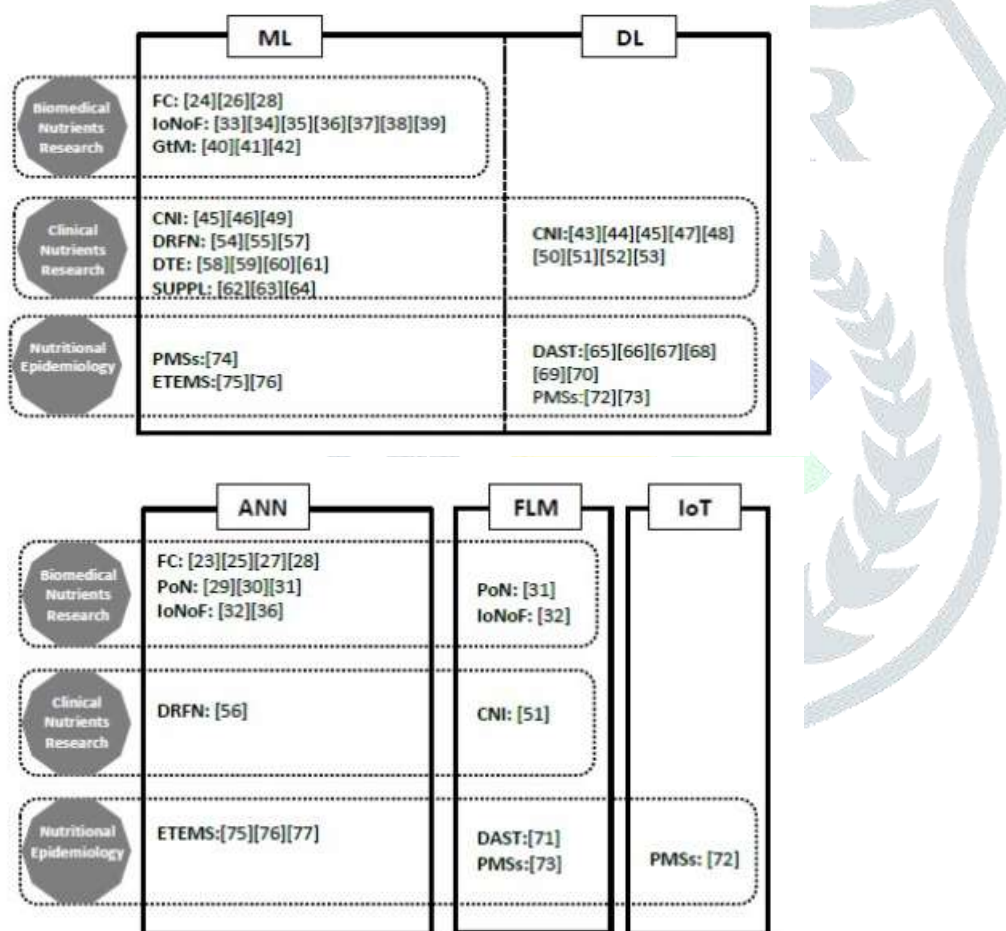

Figure 2: Nutrient science analysis studies involving computer science (AI) domains.

4. Discussion

One of the most important problems when evaluating publications on the use of AI in nutrient analysis is the variety of research areas to be considered. This type of research creates an alarmingly diverse range of problems. They are not limited to the specialist medical field, but they also apply to the improvement of plants and animals and the improvement of microorganisms. The boundaries identified within the methodology of the review were characterized by an intent to be transparent, therefore studies directly or indirectly related to human health were included, without research on nutrients in agricultural and veterinary science The literature search revealed 3 areas of application for AI technology: special nutrient analysis, clinical nutrient research and epidemiology of biological processes.

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