Neural Network training

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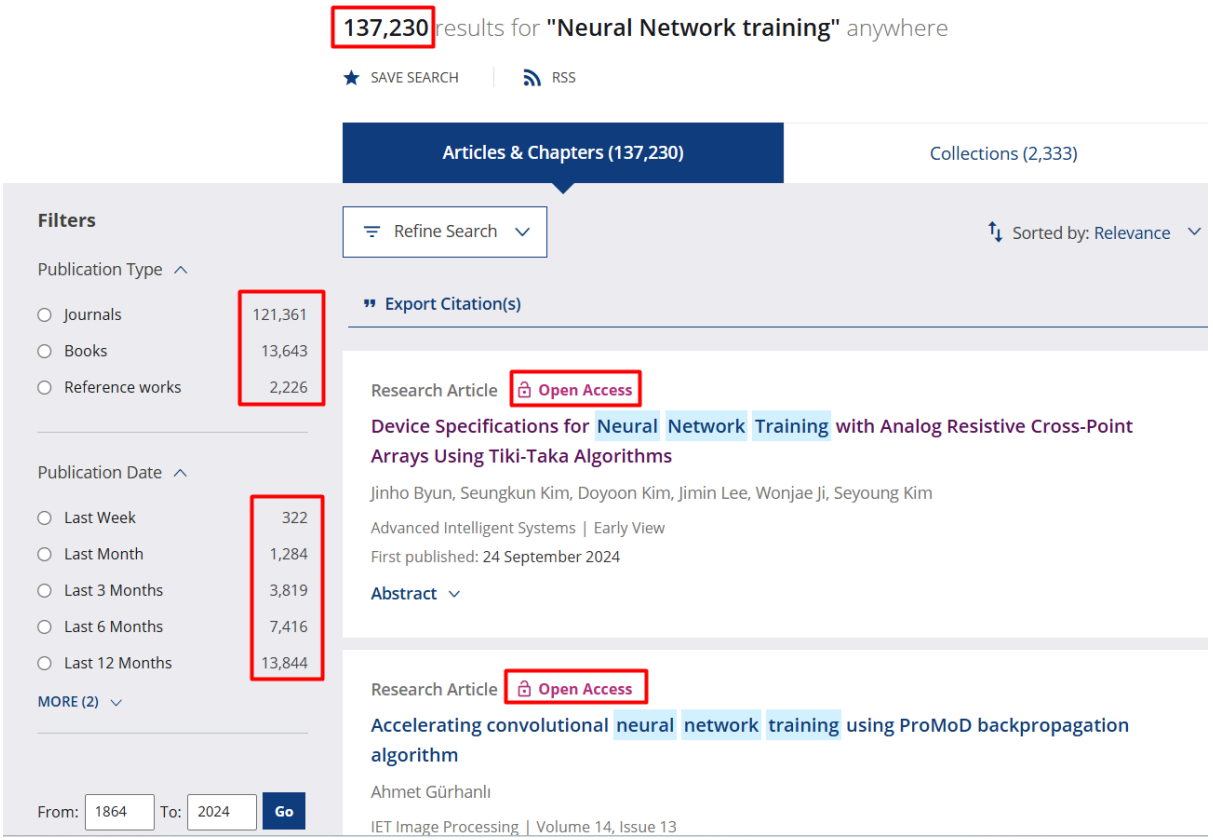

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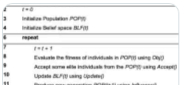

Artificial neural networks are amongst the artificial intelligence techniques with their ability to

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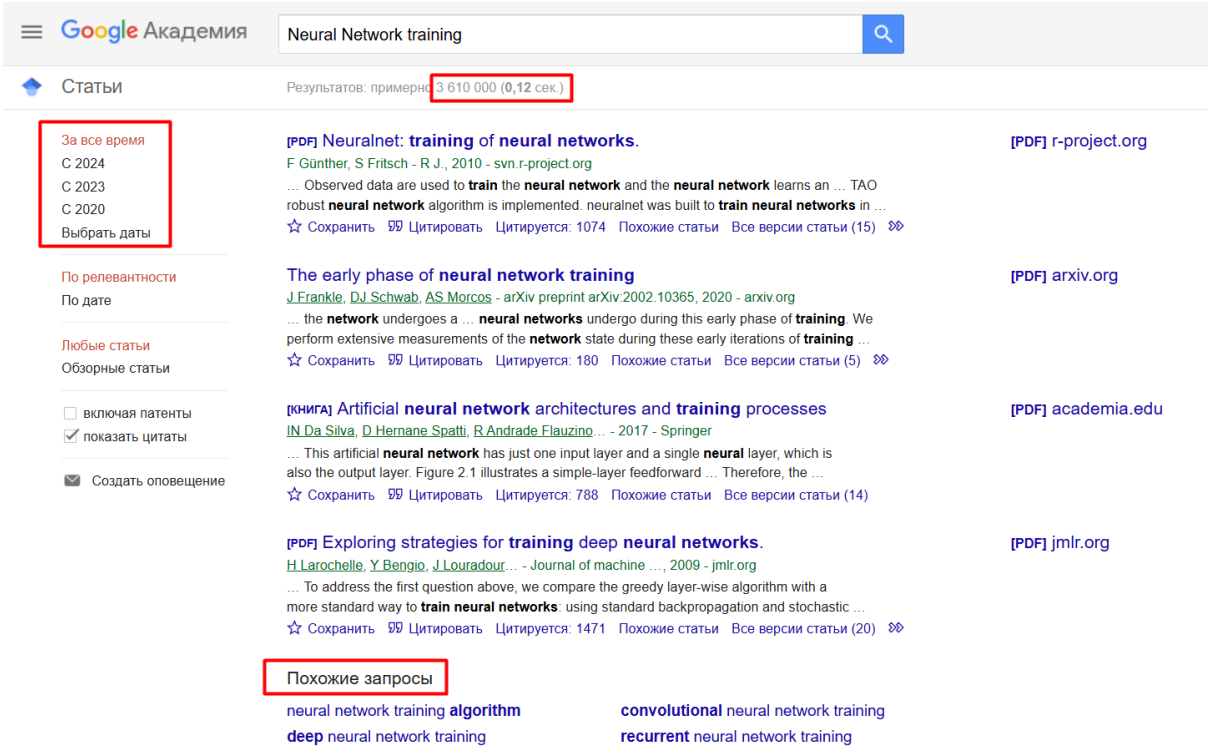

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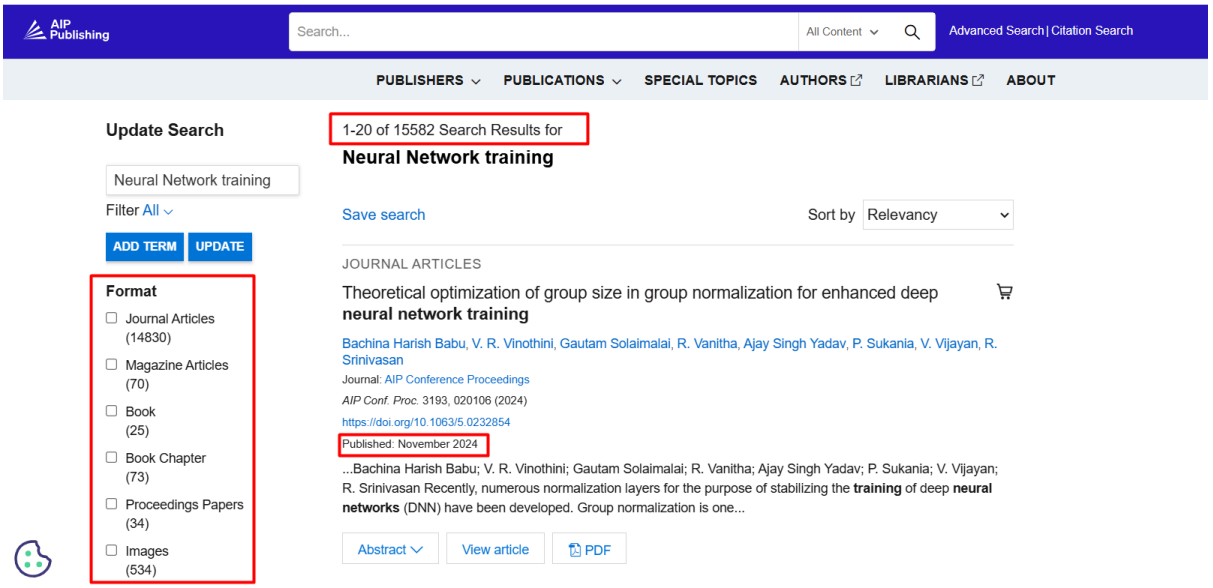

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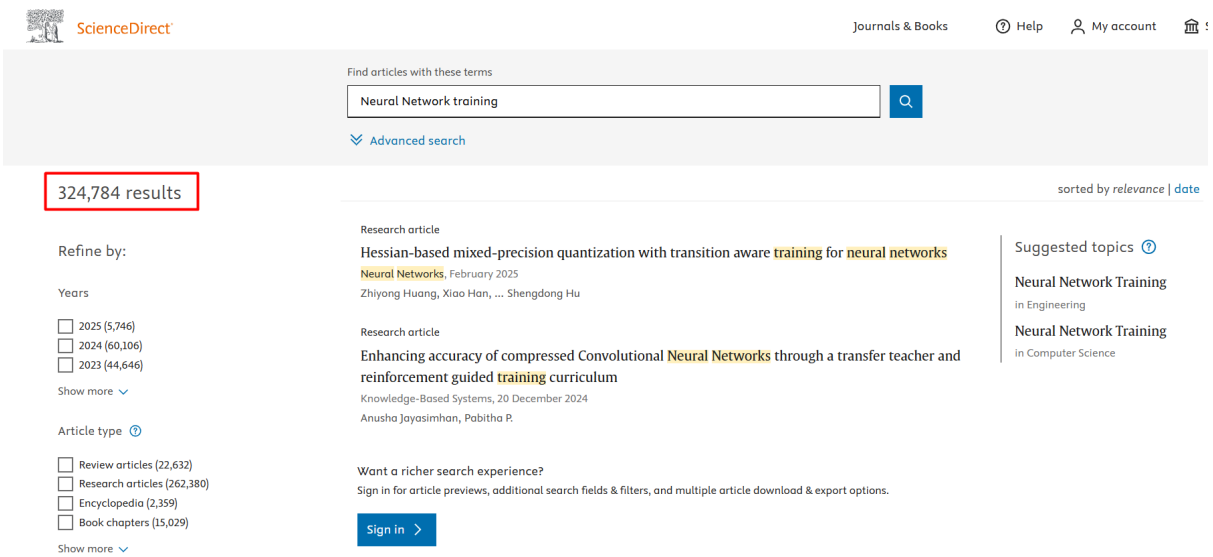

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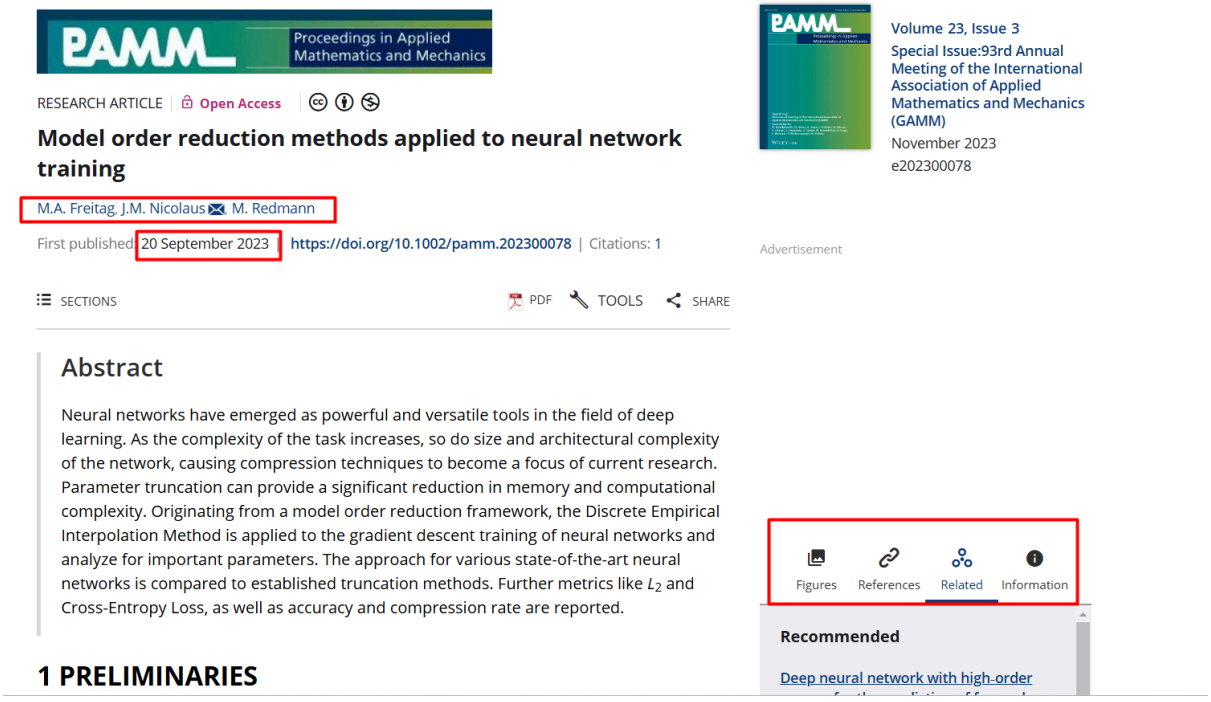

Resource constrained neural network training

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Scientific Reports

Mariusz Pietrołaj & Marek Blok

Abstract

1. Abiodun, O. I. *et al.* State-of-the-art in artificial neural network applications: A survey. *Heliyon* **4**(11), e00938. https://doi.org/10.1016/j.heliyon.2018.e00938 (2018).

Article PubMed PubMed Central Google Scholar

2. LeCun, Y. 1.1 Deep learning hardware: Past, present, and future. *IEEE International Solid-State Circuits Conference (ISSCC)*, 12–19. IEEE. https://doi.org/10.1109/ISSCC.2019.8662396 (2019).

3. Kahan, W. IEEE standard 754 for binary floating-point arithmetic. *Lecture Notes on the Status of IEEE 754* (94720-1776), 11 (1996).

4. Mach, S., Rossi, D., Tagliavini, G., Marongiu, A., & Benini, L. A transprecision floating-point

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Pietrołaj, M., Blok, M. Resource constrained neural network training. *Sci Rep* **14**, 2421 (2024). https://doi.org/10.1038/s41598-024-52356-1

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Computer Science > Machine Learning

[Submitted on 24 Feb 2020]

The Early Phase of Neural Network Training

Jonathan Frankle, David J. Schwab, Ari S. Morcos

Recent studies have shown that many important aspects of neural network learning take place within the very earliest iterations or epochs of training. For example, sparse, trainable sub-networks emerge (Frankle et al., 2019), gradient descent moves into a small subspace (Gur-Ari et al., 2018), and the network undergoes a critical period (Achille et al., 2019). Here, we examine the changes that deep neural networks undergo during this early phase of training. We perform extensive measurements of the network state during these early iterations of training and leverage the framework of Frankle et al. (2019) to quantitatively probe the weight distribution and its reliance on various aspects of the dataset. We find that, within this framework, deep networks are not robust to reinitializing with random weights while maintaining signs, and that weight distributions are highly non-independent even after only a few hundred iterations. Despite this behavior, pre-training with blurred inputs or an auxiliary self-supervised task can approximate the changes in supervised networks, suggesting that these changes are not inherently label-dependent, though labels significantly accelerate this process. Together, these results help to elucidate the network changes occurring during this pivotal initial period of learning.

Comments: ICLR 2020 Camera Ready. Available on OpenReview at this https URL
Subjects: **Machine Learning (cs.LG)**; Neural and Evolutionary Computing (cs.NE); Machine Learning (stat.ML)
Cite as: arXiv:2002.10365 **[cs.LG]**
(or arXiv:2002.10365v1 **[cs.LG]** for this version)
https://doi.org/10.48550/arXiv.2002.10365

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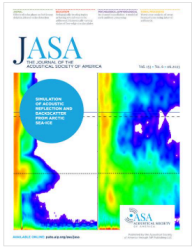

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JUNE 07 2023

Integrating modeled environmental variability into neural network training for underwater source localization

Pedro Diniz; Rogério Calazan

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J. Acoust. Soc. Am. 153, 3201 (2023)
https://doi.org/10.1121/10.0019632 **Article history**

Share Tools

Supervised machine learning (ML) is a powerful tool that has been applied to many fields of underwater acoustics, including acoustic inversion. ML algorithms depend on the existence of extensive labeled datasets, which are difficult to obtain for the task of underwater source localization. A feed-forward neural network (FNN) trained on imbalanced or biased data may end up suffering

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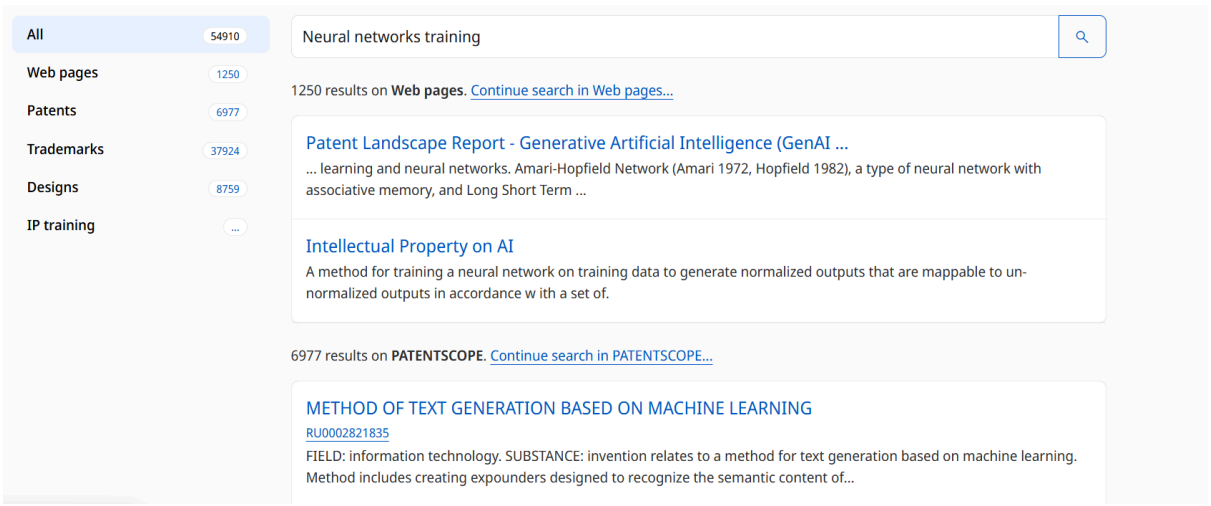
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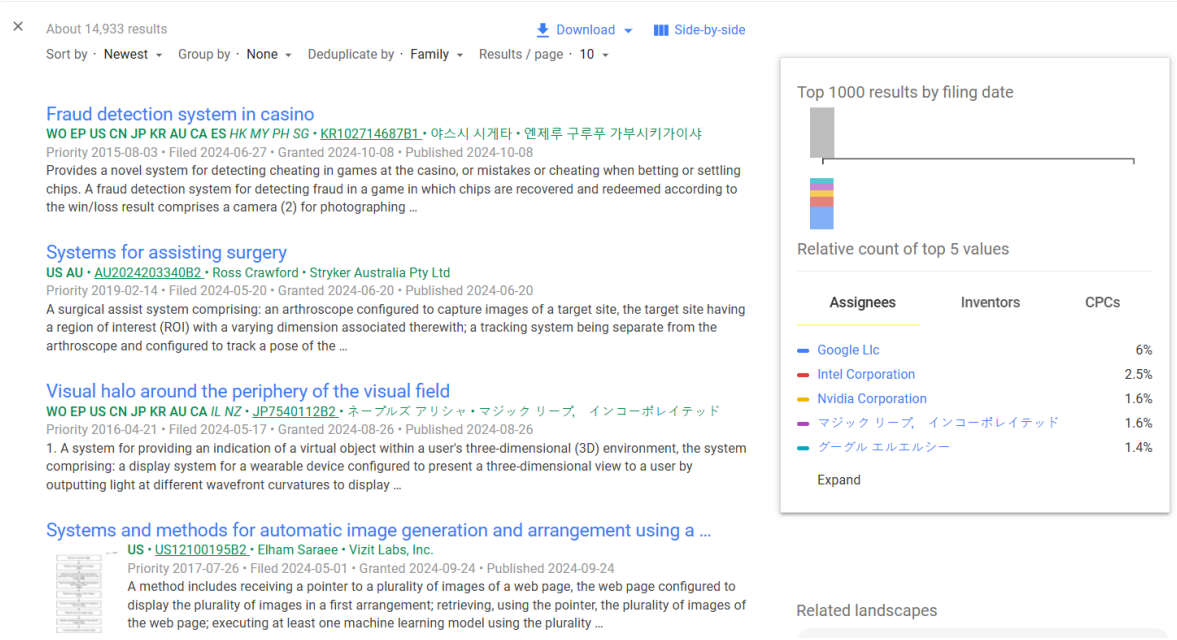

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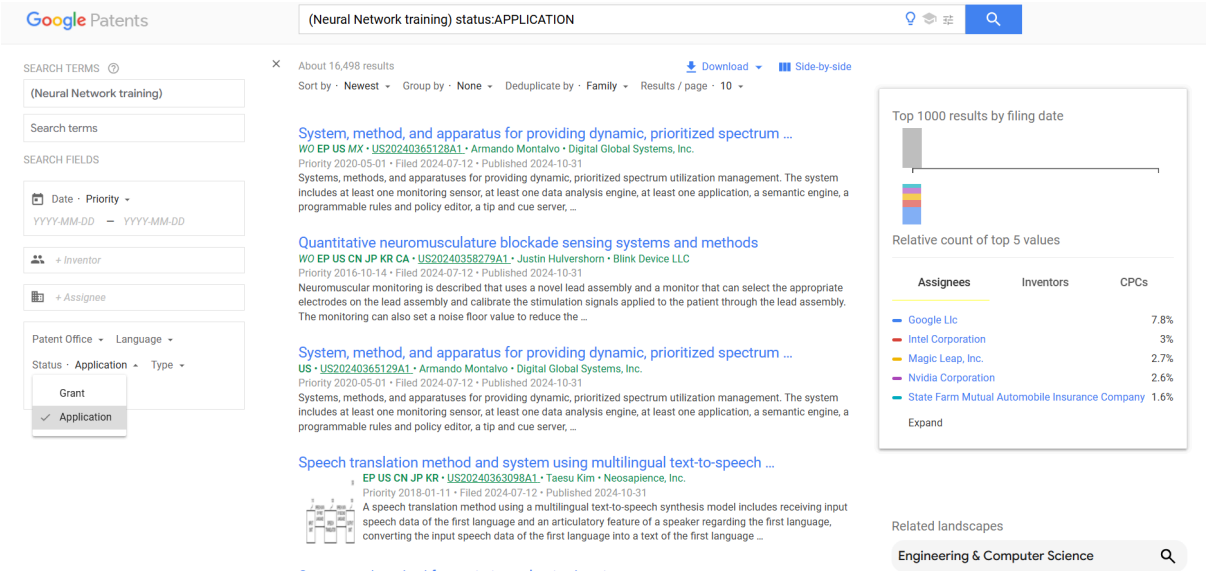

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Fraud detection system in casino

Abstract

translated from Korean

Provides a novel system for detecting cheating in games at the casino, or mistakes or cheating when betting or settling chips.
A fraud detection system for detecting fraud in a game in which chips are recovered and redeemed according to the win/loss result comprises a camera (2) for photographing chips (9) accommodated in a chip tray (17) of a dealer (5), an image analysis device (12) for analyzing an image captured by the camera (2) and detecting the value of the chips (9) accommodated in the chip tray (17), a card distribution device (13) for determining the win/loss result of the game, and a control device (14) for detecting fraud by comparing the win/loss result of the game with the value of the chips (9) accommodated in the chip tray (17) before and after the recovery and redemption of the chips.

Classifications

G07F17/3241 Security aspects of a gaming system, e.g. detecting cheating, device integrity, surveillance

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Engineering & Computer Science

Physics & Mathematics

KR102714687B1
South Korea

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Other languages: Korean

Inventor: 야스시 시게타

Worldwide applications

2016 • CN CN CN AU CN AU KR EP EP CN *SG* CN US CN CN EP ES *SG* KR *SG SG* CN CN EP *MY* JP *SG* CN WO CN ES *SG SG* CN *SG* EP *SG MY* CN EP CN KR EP EP *SG SG* EP CA EP *SG* CN *SG* ES CN ES *SG SG* CN ES EP CN *SG SG* KR *SG* EP CN CN CN KR CN KR *SG* CN *SG* CN CN EP JP US CN CN EP *SG SG* EP CN *SG PH* EP CN EP EP *SG* CN CA CN *SG SG* ES CN KR CN CN *SG* CN CN EP EP EP *SG* CN CN *SG* 2017 • JP AU CN CN CN CN CN 2018 • *PH* JP JP JP US KR *SG* AU *SG SG* CN *SG PH SG* US CN *HK* US US US KR KR JP JP US US AU AU AU 2019 • US KR AU US US US US JP JP AU AU AU US US US *PH PH PH* AU US *PH* JP US 2020 • JP KR *PH* JP US AU JP JP *PH PH* US US US US *PH PH PH* US *PH* US KR AU AU AU KR US JP 2021 • AU JP JP AU US US AU AU AU JP KR KR JP JP US US US AU AU AU US KR AU AU JP AU US AU JP *PH* JP US US JP AU AU JP KR KR KR US 2022 • AU JP US KR JP AU KR JP US AU JP JP AU KR US JP JP JP AU US KR KR KR US US AU AU KR US US AU US AU AU JP JP JP AU JP US AU JP KR US JP AU AU KR JP US 2023 • KR US US US US US KR US AU US US AU AU AU AU US AU JP KR AU JP KR KR US JP US AU US JP US AU JP JP US AU AU US KR AU JP AU US JP AU AU AU AU 2024 • AU AU JP AU JP JP JP AU AU

Patent Citations (286)

Publication number	Priority date	Publication date	Assignee	Title
US20070077987A1	2005-05-03	2007-04-05	Tangam Gaming Technology Inc.	Gaming object recognition
US20120040727A1	2005-05-03	2012-02-16	Tangam Technologies Inc.	Table game tracking
Family To Family Citations				
US4026309A	1974-08-08	1977-05-31	Gamex Industries Inc.	Chip structure
US4814589A	1986-04-18	1989-03-21	Leonard Storch	Information transfer and use, particularly with respect to objects such as gambling chips
JPS6450243A	1987-08-20	1989-02-27	Fujitsu General Ltd	Optical disk recording and reproducing device
JPH03102917A	1989-09-18	1991-04-30	Fujitsu Ltd	A/d converter
JPH03114435A	1989-09-28	1991-05-15	Toshiba Corp	Diagnostic system
JPH03102917U	1990-02-09	1991-10-25		
JP3034975B2	1991-03-26	2000-04-17	株式会社東芝	Pattern feature extraction method
JPH05237213A	1992-02-27	1993-09-17	Misawa Homes Co Ltd	Image processing method and device for 'go' game device
JP2978374B2	1992-08-21	1999-11-15	松下電器産業株式会社	Image processing device, image processing method, and control device for air conditioner
JPH06134140A	1992-10-23	1994-05-17	Lsi Japan Kk	System for counting point of game, device for counting point of game and chip for game
US5361885A	1993-02-23	1994-11-08	Peter Modler	Anticounterfeiting device for gaming chips
US5530837A	1994-03-28	1996-06-25	Hewlett-Packard Co.	Methods and apparatus for interleaving memory transactions into an arbitrary number of banks

Legal Events

Date	Code	Title	Description
2024-06-27	A107	Divisional application of patent	
2024-07-09	E701	Decision to grant or registration of patent right	
2024-10-02	GRNT	Written decision to grant	

Concepts

machine-extracted

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Name	Image	Sections	Count	Query match
detection method		title,abstract,description	79	0.000
Gambling		claims,description	45	0.000
deep learning		claims,description	31	0.000
artificial intelligence		claims,description	16	0.000
abnormality		claims,description	3	0.000
image analysis		abstract,description	101	0.000
recovery		abstract,description	37	0.000

Systems for assisting surgery

Abstract

A surgical assist system comprising: an arthroscope configured to capture images of a target site, the target site having a region of interest (ROI) with a varying dimension associated therewith; a tracking system being separate from the arthroscope and configured to track a pose of the arthroscope and a pose of the target site to detect one or more conditions associated with the arthroscope and the target site; and one or more controllers coupled to the arthroscope and to the tracking system and being configured to determine the varying dimension of the ROI at each of a plurality of times based on images from the arthroscope and the conditions detected by the tracking system. 98

Classifications

A61B34/10 Computer-aided planning, simulation or modelling of surgical operations

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Inventor: Ross Crawford, Anjali Jaiprakash, Jonathan Roberts, Mario Strydom

Current Assignee : Stryker Australia Pty Ltd

Worldwide applications

2020 • AU US 2024 • US AU AU

Application AU2024203340A events

2019-02-14 • Priority claimed from AU2019900476A
2024-05-20 • Application filed by Stryker Australia Pty Ltd
2024-05-20 • Priority to AU2024203340A
2024-06-06 • Publication of AU2024203340A1
2024-06-20 • Application granted
2024-06-20 • Publication of AU2024203340B2
2024-08-21 • Priority to AU2024213128A

Description

SYSTEMS FOR ASSISTING SURGERY
TECHNICAL FIELD

The present invention relates to systems for assisting surgery.

BACKGROUND

Any references to methods, apparatus or documents of the prior art are not to be taken as constituting any evidence or admission that they formed, or form part of the common general knowledge.

While leg knee and hip joint surgery are common procedures, they require a skilled and experienced surgeon to repair damage to ajoint, for example for the knee joint a surgeon operates inside a small space whilst manually moving the patient's leg and steering the surgical instruments, such as the arthroscope, inside the joint through a small incision. Such procedures are challenging, and research shows that a safer environment can be created by providing feedback to the surgeon when moving a patient's limb, or using a robot to perform all or part of the surgery, to adjust the joint. It would be desirable if a system were provided to measure a region of interest (ROI) such as a joint gap reliably. Stereo systems used in other minimally invasive surgeries (MIS) are not suited for knee arthroscopy for example, due to the small size of the arthroscope with only a single lens and the harsh environment inside the knee joint.

Although a few technologies such as deep learning can measure distance inside the body, it is necessary to consider the precision required and thus, the practical use of technology during surgical procedures such as an arthroscopic procedure. A surgeon or robot's (Operator) capability to manoeuvre the surgical instrument or 4mm wide arthroscope tip through an instrument gap of a few millimetres varies and affects the measurement technology and error tolerance range for safe navigation. For surgeons, factors such as experience, age and fatigue limit their ability to manoeuvre instruments through a gap seen on a 2D image. For robots, the manufacturing quality of links, gearboxes and controls determine how accurate they can steer an end effector such as an arthroscope.

Claims (18)

Hide Dependent

1. A surgical assist system comprising: an arthroscope configured to capture images of a target site, the target site having a region of interest (ROI) with a varying dimension associated therewith; a tracking system being separate from the arthroscope and configured to track a pose of the arthroscope and a pose of the target site to detect one or more conditions associated with the arthroscope and the target site; and one or more controllers coupled to the arthroscope and to the tracking system and being configured to determine the varying dimension of the ROI at each of a plurality of times based on images from the arthroscope and the conditions detected by the tracking system.

2. The surgical assist system of claim 1, further comprising one or more actuators being configured to move the target site, and wherein the one or more controllers are configured to operate the one or more actuators for physically altering the ROI to bring the varying dimension to a desired value.

3. The surgical assist system of claim 1, wherein the one or more controllers are configured to: apply a mask to one or more of the images for masking around the ROI; and segment each image to identify the ROI with the varying dimension associated therewith.

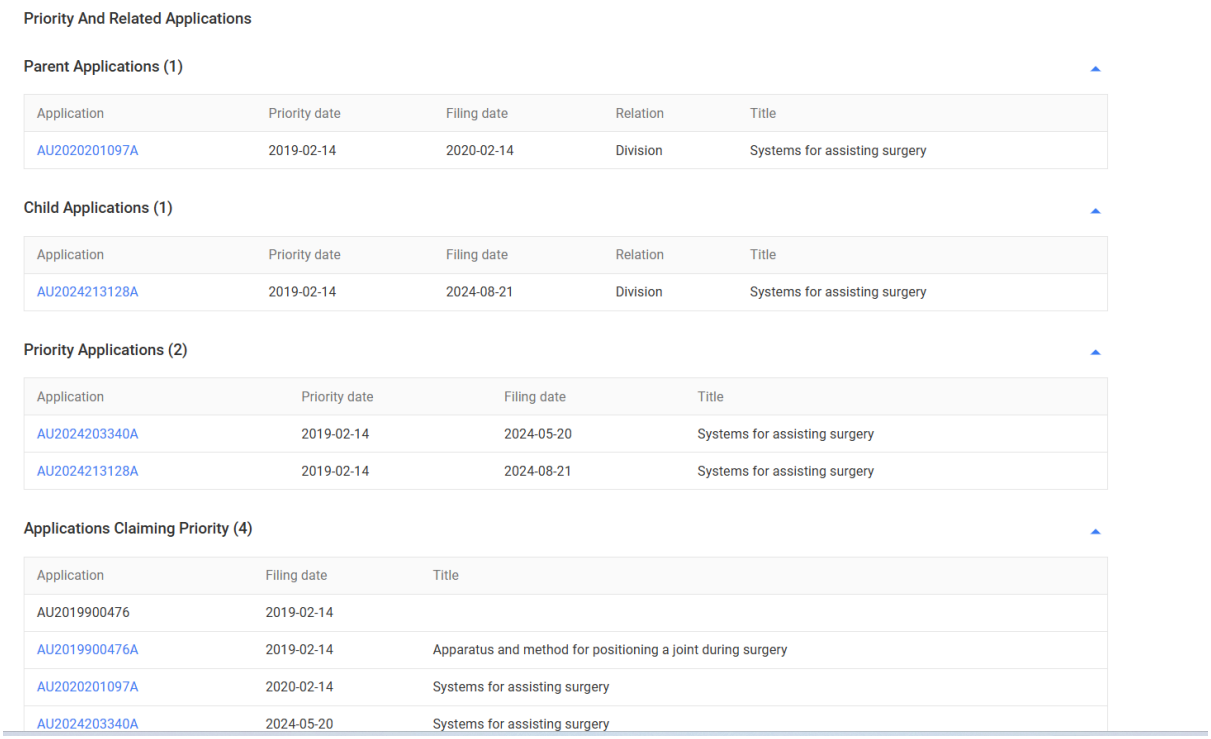
4. The surgical assist system of claim 3, wherein the one or more controllers are configured to determine a translation of the arthroscope from the conditions detected by the tracking system.

5. The surgical assist system of claim 4, wherein the one or more controllers are configured to approximate an uncertainty in determination of the varying dimension by taking into account one or more of the following: errors associated with segmentation of one or more of the images; errors in the tracking system detecting the translation of the arthroscope; and errors in the tracking system detecting rotational motion of the arthroscope.

6. The surgical assist system of claim 4, wherein the ROI comprises

Patent Citations (21)

Publication number	Priority date	Publication date	Assignee	Title
Family To Family Citations				
EP0201883A3	1985-05-14	1988-01-13	ANDRONIC DEVICES Ltd.	Advanced medical robot
US5007912A	1990-05-30	1991-04-16	Albrektsson Bjoern	Arrangement for fixing a knee-joint in defined positions and for positional control of instruments for replacing the knee-joint with a prosthesis
US5645079A	1994-12-02	1997-07-08	Zahiri; Hormoz	Apparatus for mechanically holding, maneuvering and maintaining a body part of a patient during orthopedic surgery
US20090012533A1 *	2007-04-23	2009-01-08	Hansen Medical, Inc.	Robotic instrument control system
US8180126B2 *	2007-08-13	2012-05-15	University Of Maryland, Baltimore	Detecting meniscal tears in non-invasive scans
US9165199B2 *	2007-12-21	2015-10-20	Honda Motor Co., Ltd.	Controlled human pose estimation from depth image streams
JP2012523897A *	2009-04-16	2012-10-11	コンフォーミス・インコーポレイテッド	Patient-specific joint replacement device for ligament repair
EP2603142A1 *	2010-08-13	2013-06-19	ERMI, Inc.	Robotic knee testing device, subjective patient input device and methods for using same
US8843236B2 *	2012-03-15	2014-09-23	GM Global Technology Operations LLC	Method and system for training a robot using human-assisted task demonstration
US9675471B2 *	2012-06-11	2017-06-13	Conformis, Inc.	Devices, techniques and methods for assessing joint spacing, balancing soft tissues and obtaining desired kinematics for joint implant components
US10292887B2	2012-12-31	2019-05-21	Mako Surgical Corp.	Motorized joint positioner
US10390737B2	2013-09-30	2019-08-27	Stryker Corporation	System and method of controlling a robotic system for manipulating anatomy of a patient during a surgical procedure



Priority And Related Applications

Parent Applications (1)

Application	Priority date	Filing date	Relation	Title
AU2020201097A	2019-02-14	2020-02-14	Division	Systems for assisting surgery

Child Applications (1)

Application	Priority date	Filing date	Relation	Title
AU2024213128A	2019-02-14	2024-08-21	Division	Systems for assisting surgery

Priority Applications (2)

Application	Priority date	Filing date	Title
AU2024203340A	2019-02-14	2024-05-20	Systems for assisting surgery
AU2024213128A	2019-02-14	2024-08-21	Systems for assisting surgery

Applications Claiming Priority (4)

Application	Filing date	Title
AU2019900476	2019-02-14	
AU2019900476A	2019-02-14	Apparatus and method for positioning a joint during surgery
AU2020201097A	2020-02-14	Systems for assisting surgery
AU2024203340A	2024-05-20	Systems for assisting surgery

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