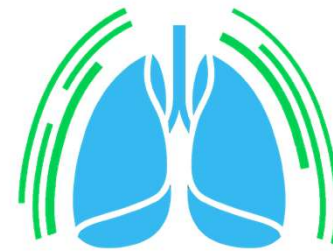


Projekt Akustik

Lunge

01.03.2023



Lungenpraxis Aalen
länger ausatmen

Künstliche Intelligenz in der Medizin

- Ziele:
- Zukunft ohne Mensch
- Vermeidung von Fehlern
- Reduktion der Mortalität
- Ca\$h
- Forbes Magazine:
- 2021: 6,6 Mrd \$ Investitionen
- 2026: 150 Mrd \$ Gewinn



KI in der Medizin: Hot Topics

1. Diagnostik (predictive, preventive): Bildgebung
2. Entwicklung von Medikamenten
3. Chirurgie: Training, OP
4. Krankenhausaufenthalt: ABS, Entscheidungen, Therapie
5. Prothesen: Anpassung, Design, Steuerung
6. Optometrie: Retinascan Google Deep mind gewinnt
7. Onkologie: Diagnose, Therapie
8. Zahnmedizin: Lokalisation, Design, Implantation



of client data

Pneumologie

- Artikel überschaubar, besonders wenn Intensivmedizin ausgeklammert
- Wenig Major paper
- Hauptsächlich Bildgebung
- Domäne Lungenkarzinom


The screenshot shows a PubMed search results page for the query "artificial intelligence in pulmonary medicine". The search bar at the top contains the query and a "Search" button. Below the search bar, there are options for "Advanced", "Create alert", "Create RSS", and "User Guide". The results are sorted by "Best match" and there are buttons for "Save", "Email", and "Send to".

On the left side, there are filters for "MY NCBI FILTERS", "RESULTS BY YEAR" (with a bar chart showing an increase in results from 1989 to 2023), "TEXT AVAILABILITY" (with checkboxes for Abstract, Free full text, and Full text), "ARTICLE ATTRIBUTE" (with a checkbox for Associated data), and "ARTICLE TYPE" (with checkboxes for Books and Documents, Clinical Trial, and Meta-Analysis).

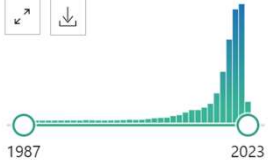
The main results area shows 1,704 results. The first result is highlighted with a yellow background and is titled "Artificial intelligence in pulmonary medicine: computer vision, predictive model and COVID-19." by Khemasuwan D, et al. The second result is titled "Artificial intelligence and machine learning in respiratory medicine." by Mekov E, Miravitlles M, Petkov R. The third result is titled "Artificial Intelligence in the Intensive Care Unit." by Gutierrez G.

Kardiologie

- Immer einen Herzschlag voraus
- Bildanalyse (Echo)
- Datenanalyse
- Empfehlung weiterer diagnostischer Schritte
- -> Unterstützung der Diagnose
- Wo könnte Einsatz in der Pneumologie sein?

MY NCBI FILTERS  9,487 results Page 1 of 949

RESULTS BY YEAR



TEXT AVAILABILITY

- Abstract
- Free full text
- Full text

ARTICLE ATTRIBUTE

- Associated data

ARTICLE TYPE

- Books and Documents
- Clinical Trial
- Meta-Analysis
- Randomized Controlled Trial

1 **Artificial Intelligence in Cancer Research and Precision Medicine.**
Bhinder B, Gilvary C, Madhukar NS, Elemento O.
Cite Cancer Discov. 2021 Apr;11(4):900-915. doi: 10.1158/2159-8290.CD-21-0090.
PMID: 33811123 [Free PMC article.](#) [Review.](#)
Share **Artificial intelligence (AI)** is rapidly reshaping **cancer** research and personalized clinical care. ...Here, we review the recent enormous progress in the application of AI to oncology, highlight limitations and pitfalls, and chart a path for adoption of AI in ...

2 **Predicting cancer outcomes with radiomics and artificial intelligence in radiology.**
Bera K, Braman N, Gupta A, Velcheti V, Madabhushi A.
Cite Nat Rev Clin Oncol. 2022 Feb;19(2):132-146. doi: 10.1038/s41571-021-00560-7. Epub 2021 Oct 18.
PMID: 34663898 [Free PMC article.](#) [Review.](#)
Share The successful use of **artificial intelligence (AI)** for diagnostic purposes has prompted the application of AI-based **cancer** imaging analysis to address other, more complex, clinical needs. ...We hope to demystify AI in radiology for clinicians by helping them ...

3 **Artificial intelligence in oncology.**
Shimizu H, Nakayama KI.
Cite Cancer Sci. 2020 May;111(5):1452-1460. doi: 10.1111/cas.14377. Epub 2020 Mar 21.
PMID: 32133724 [Free PMC article.](#) [Review.](#)
Share **Artificial intelligence (AI)** has contributed substantially to the resolution of a variety of biomedical problems, including **cancer**, over the past decade. ...We also highlight resources and datasets that can help harness the power of AI for **cancer** resea ...

ography; Lab = laboratory testing; MPI = myocardial perfusion imaging; SPECT = single-photon emission computed tomography.

Diagnostische Arbeit

- Welche Untersuchungstechnik trägt was zur Diagnose bei?
 - Anamnese
 - Körperliche Untersuchung
 - Lungenfunktion
 - Bildgebung
 - Invasive Diagnostik
 - Labor
- Bei uns:
 - Anamnese: 10/10 (führt Diagnose an)
 - Körperliche Untersuchung 10/10
 - Lungenfunktion 10/10
 - Bildgebung 6/10
 - Invasive Diagnostik 2/10
 - Labor 4/10

Themenvorschlag

- <https://youtu.be/yHeNsynAMgE>
- 1:30



Auskultation

- Atemgeräusche entstehen durch Turbulenzen
- Sie werden beeinflusst durch multiple Komponenten und enthalten entsprechend Fehlerquellen
- Vorteil: überall verfügbar, leicht durchzuführen
- Nachteil: subjektiv (interobserver variability)
- → Basiskennntnis, schneller erster Eindruck...
- Ideal: aufrecht, unbedeckt, vorne/hinten, möglichst gleicher Untersuchungsweg, im Seitenvergleich



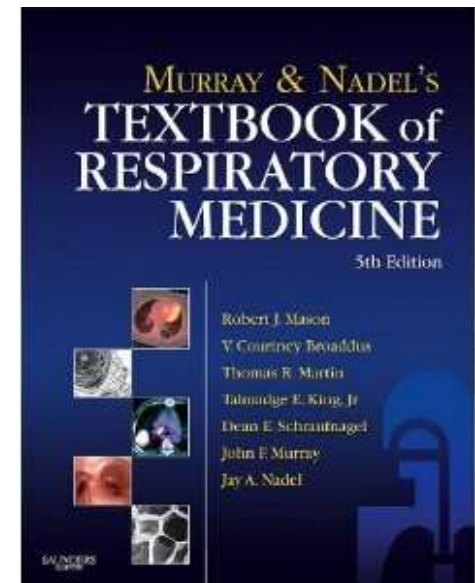
Physiologie

- Frequenzbereich zwischen 100 Hz bis 5000 Hz
- Besonders zwischen 100-800Hz, wenig Energie oberhalb 1500Hz
- Menschliches Ohr 20 -20000 Hz



Auskultation

- Unterschiedliche Nomenklaturen verfügbar
- Einigkeit: Frequenz, Intensität, Qualität
- Normale Atemgeräusche (Vesikuläratmen (Physiologen..), zentrales Atemgeräusch, peripheres Atemgeräusch)
- Abnorme Atemgeräusche:
 - Kontinuierlich (>80ms): Pfeifen (Wheeze)/ Rhonchus (Rasseln)/ Stridor/
 - Diskontinuierlich (<15ms): Rasselgeräusche fein/grob
 - Bzgl. Ort und Phänomenologie auffällig



Lung Sounds

Although there has been much progress in diagnosing pulmonary disease and various are essential part of the physical examination (see also [12]). The usefulness of this component of the physical examination depends on understanding the principles, limits of respiratory function and proper correlation with the available clinical data. Lung auscultation is a test, sensitive, safe, and relatively easy to perform. However, lung auscultation is limited by interobserver variability, in-adequate understanding of the pathologic basis of respiratory function, and respiratory observation. These discrepancies in interpretation should not overshadow the clinical importance and pathogenesis of these valuable diagnostic tools.

Lung auscultation can be classified as normal or abnormal. These terms are themselves highly

difficult in abnormal respiratory sounds are those heard expiratory or normal breath sounds and are further classi-fied as continuous and discontinuous. Discontinuous sounds (stridor) are further classified as "dry" or "wheezy" sounds, "wheezing continuous sounds (stridor) - 80 days) are known as "wheezing," "stridor," or "stridor." The

diagnosis based on these continuous abnormal sounds and address the location and frequency of a patient with the

problem.

Although there is no one correct way to listen to lung sounds, certain basic principles are important. Ideally, the patient should be in the quiet environment so that the breath sounds can be heard over any ambient noise. The patient should be upright if possible, and the examiner should be placed directly on the side. One lung is listened to in tandem with many breath sounds, particularly rales. One can begin on the front or back, but it is good to try to conclude with tech-niques on the front and complete examination is performed every time. Listen to at least one complete breath, including inspiration and expiration, at each level of the lung (upper, lower, or mid-ventral), and compare each side. Examine both the anterior and posterior chest, when the upper and lower lobes, respectively, are best heard. Also examine and note the results on both sides, when the lungs on the left and the right middle lobe on the right can be compared. Focus on both the qual-ity and intensity of the breath sounds. "Abnormal" breath sounds are respiratory or expiratory, and it is important to record breath sounds from abnormal sounds. One should listen over the neck and trachea as well, which may help in determining the origin of the abnormal sounds. It is particularly good practice to appreciate stridor, but whenever you hear and there also. Remember to try to compare any abnormal sounds as to their persistence within the breath cycle (continuous or

Auskultation

- Direkte Rückmeldung über die Situation der Luft in den Atemwegen
- Lungenfunktion ist extrem gute Diagnostik da standardisierbar und vergleichbar
- Kann Auskultation vergleichbar eingesetzt werden?
- Standardisierung möglich
- Technik für validierbare Diagnostik verfügbar



Frühe Arbeit: Phonopulmogramm

- Aufzeichn
- Speicheru
- Frühe Art
- 1984
- Hochtech
- Stellenwei

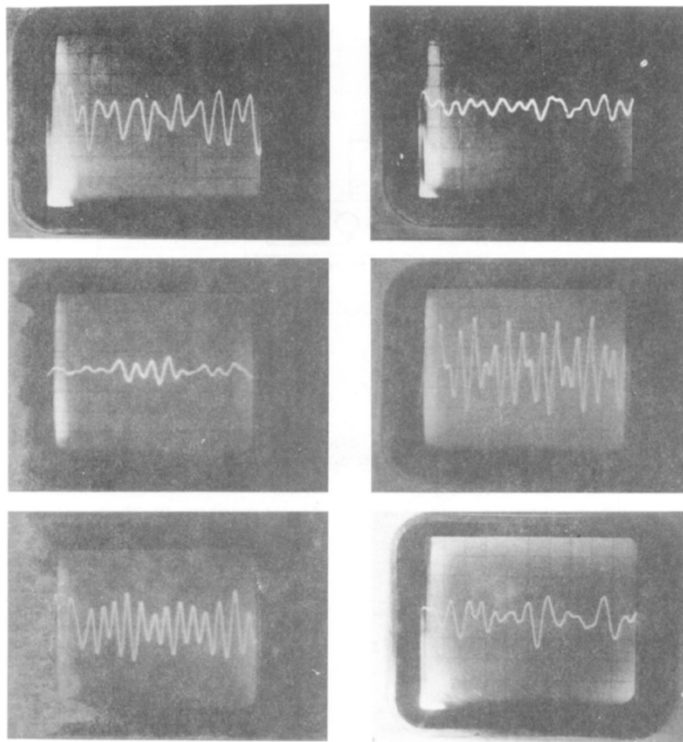


Fig.3 Typical phonopulmogram at the right lung base both for inspiration and expiration : (a) normal subject, (b) TB patient with cavity and (c) TB patient with fibrosis.

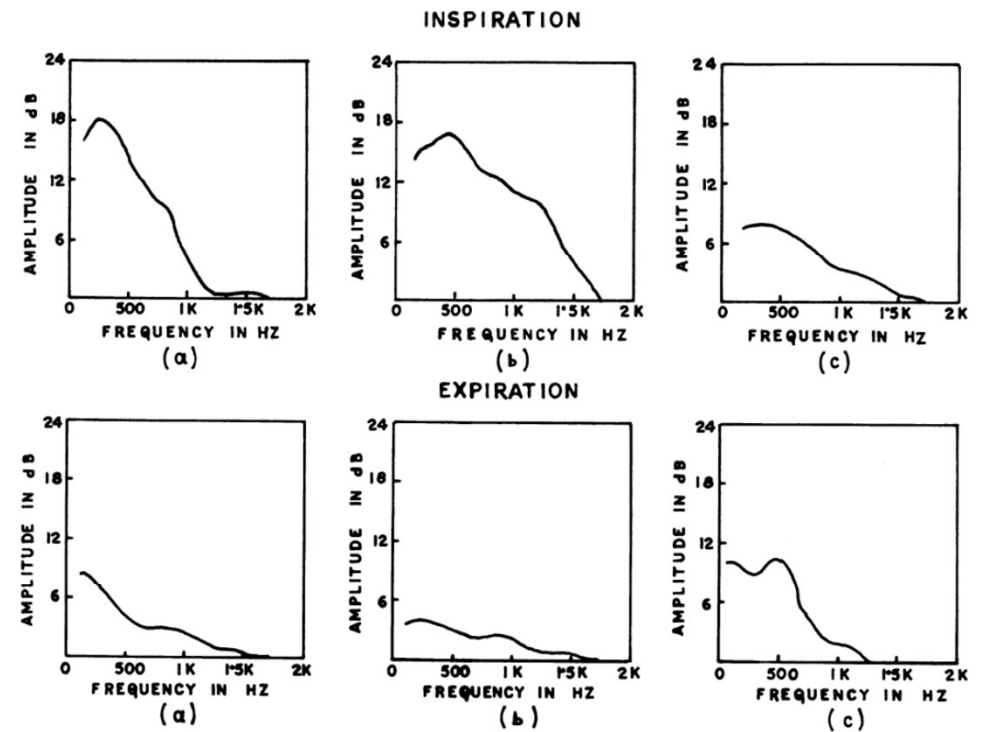


Fig.5 Frequency spectrum of phonopulmogram at the right lung base both for inspiration and expiration : (a) normal subject, (b) TB patient with cavity and (c) TB patient with fibrosis.

Frühe Arbeit: Phonopulmogramm



Fig.2 Laboratory set-up for PPG recording and digitisation.

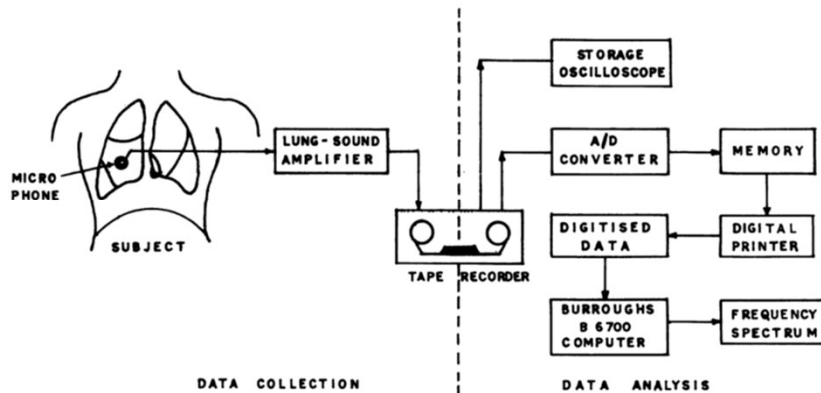


Fig.1 Schematic diagram for data collection and analysis.

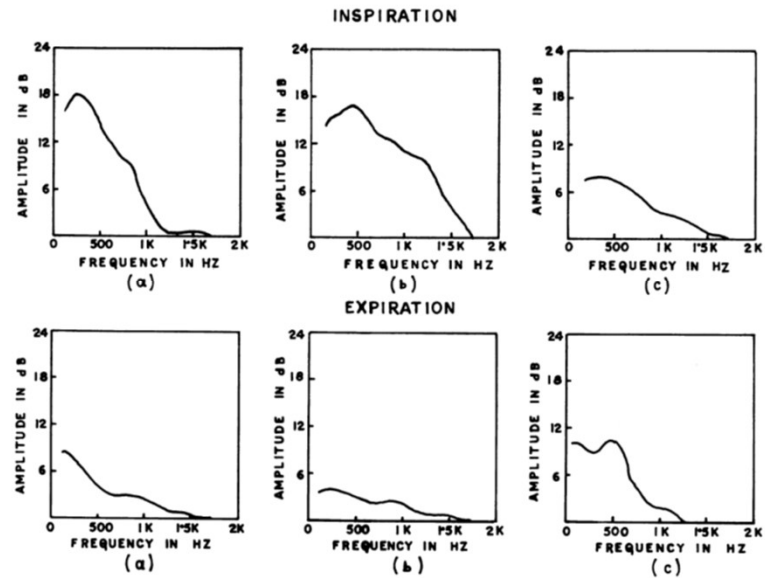


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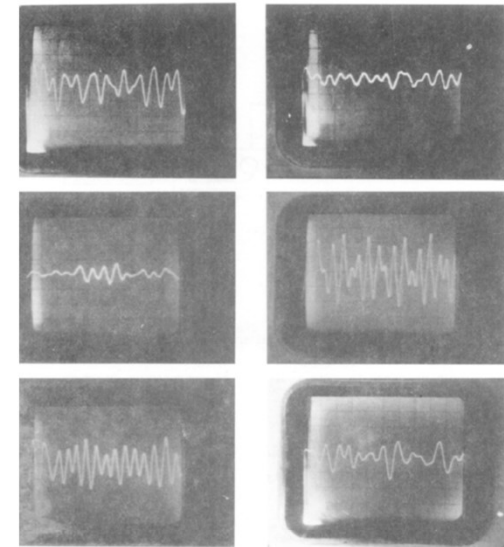
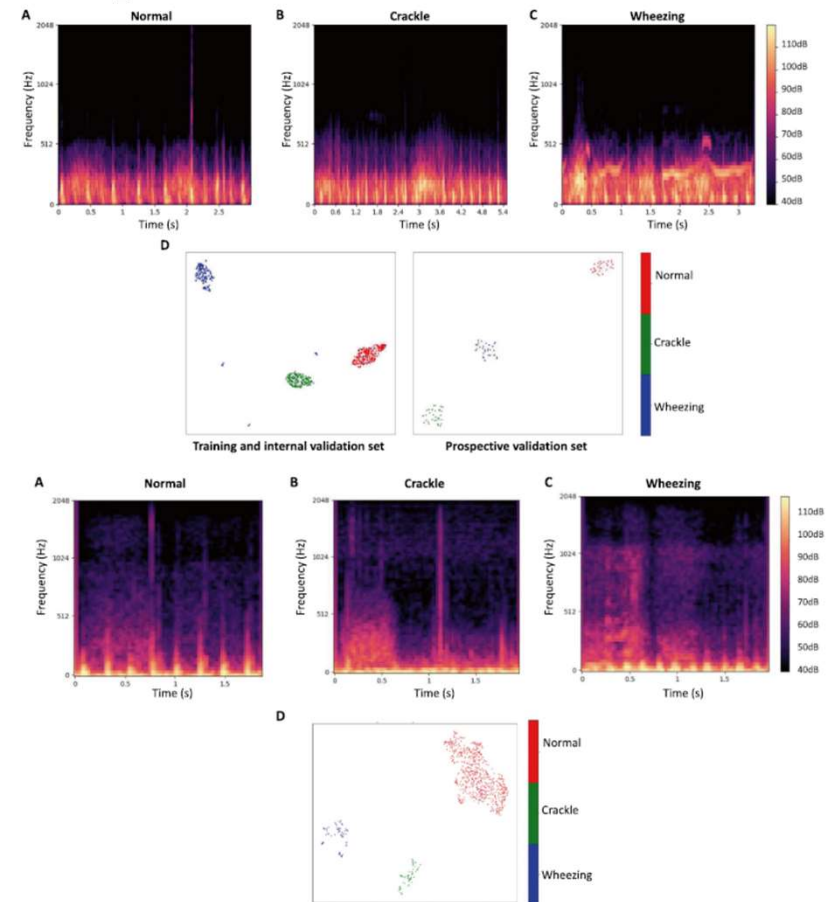


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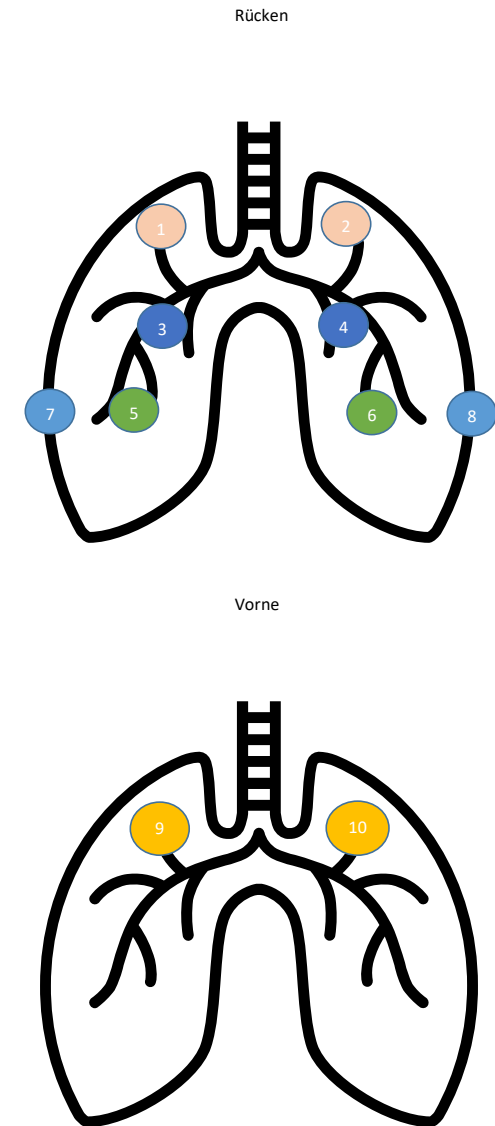
Aktuelle Arbeit: AI lung sounds

- Aufzeichnung der Lungengeräusche päd. Pat.
- Speicherung und Analyse
- Training AI auf 4 Aspekte
- Normal vs. Abnormal (83,68% → 82,22%)
- Feinblasige RG's vs wheezing (83,67% → 67,74%)
- Normal vs. Feinblasige Rasselgeräusche (80,94% → 67,80%)
- Normal vs. Wheezing (90,4% → 81,36%)



Planung

- Auskultation an 10 definierten Stellen
- Aufnahme von 10s pro Stelle
- Visualisierung mittels Software
- Mustererkennung
- Entwicklung diagnostischer Score
- These: spezifische Erkrankung durch spezifisches Muster detektierbar



Planung

- Equipment:
- Digitales Stehthoskop The One
- Aufnahme mit Field Recorder Zoom F3
(automatischer Pegel, High-Res (32bit))
- Direktes sichern unter Pat. ID
- Akustische Kontrolle AK 3000 SP, Final D8000
(High-Res), EQ Pneumologie (200-5000)
- Analyse über Software (Blackmagic/
LogicPro...)



Problemkomplexe



- Untersucherabhängige Varianz
- Aufzeichnung in ausreichender Qualität
- Beurteilung nach Aufnahme: ohne EQ für das Hörempfinden eigenartig
- Interessant: ? Effekt bei KI, welche Information liegt im nicht hörbaren/ darstellbaren Bereich?