



Nuestra experiencia usando IAs generativas en exploración tecnológica

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www.espacioidea.eu

¡Hola! Soy RTDI

RTDI presta servicios de gestión integral de I+D+i a través de dos canales: **Consultoría** dirigida a organizaciones que buscan apoyo experto para materializar sus ideas. Y **Formación**, dirigida a individuos buscando una capacitación profesional de alto valor añadido, instituciones que quieran promoverlas, y organizaciones interesadas en crear sus propias capacidades internas.

- 150+ Clientes
- 325+ Proyectos
- €230M apoyo financiero para nuestros clientes
- Desde TRL1 hasta TRL9
- Plataforma propia de herramientas para la gestión integral de proyectos de I+D+i - www.innowizard.eu

- Instrumentos pedagógicos disruptivos validados en el marco de proyectos financiados por la CE (real-work-based learning, gamificación educativa, coaching dinámico).
- 12 practitioners as coaches and trainers.
- 70+ estudiantes de master propio, que han trabajado sobre 60+ proyectos de nuestros clientes, 96% de tasa de colocación en I+D+i, 65% doctores, 68% mujeres.
- 2.300+ participantes en sesiones de formación por toda Europa, América, Norte de África y Asia.

Práctica

Capacitación

Consultoría



Formación



Algunas referencias

Sector Público



Academia



Asociaciones



Empresa privada





**Generación
de contenidos**

**Generación
de software,
etc.**

**Exploración
de
información**

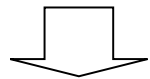
IA generativa, ¿qué es y para qué puede usarse?

Vigilancia tecnológica: ¿Qué es?

La vigilancia consiste en realizar de forma sistemática, con la aplicación de procedimientos y herramientas, la:

- Búsqueda
- Captación
- Análisis
- Organización
- Comunicación

De información (sobre tecnologías)



Para la toma de decisiones estratégicas



Vigilancia tecnológica: ¿Cómo se hace?



**Compartir nuestra
experiencia usando IAs
generativas en exploración
tecnológica**

Hemos usado...

<https://pi.ai/talk>

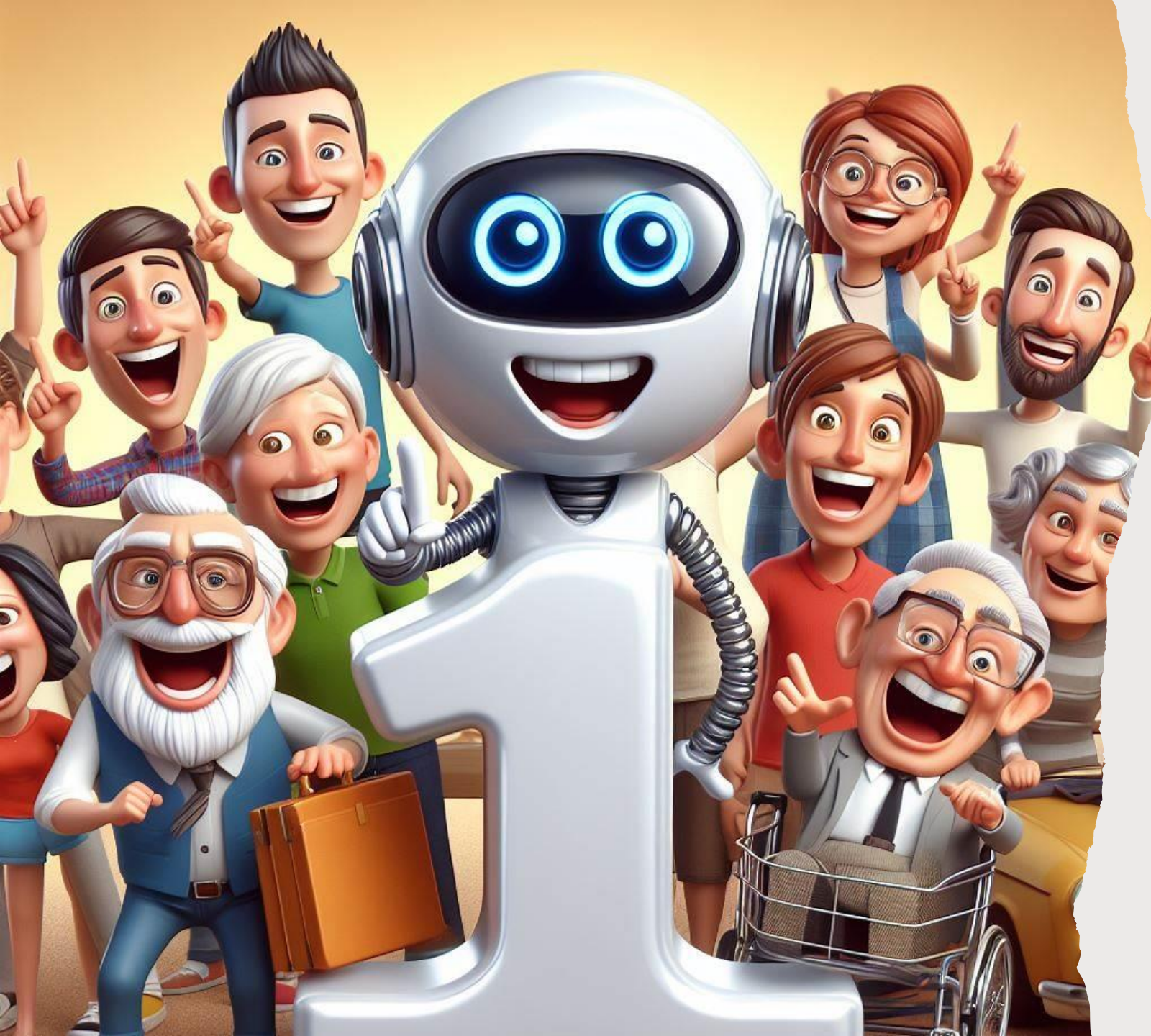
Chat GPT 3.5

Chat GPT 4

Research ChatGPT

**En... Un proyecto de cirugía
robótica**





Preparar la lista de preguntas

Lista de preguntas

1. What are the main trends in surgical robotics?
2. What are the main safety issues related to surgical robotics? Anything about their consequences?
3. Is the learning curve of using a surgery robot very long? How long?
4. Are surgery robots considered less invasive than traditional surgery?
5. What are the main trends in surgery in general?
6. What are the main barriers to surgery robotics nowadays? And towards the future?
7. How could time of surgery be reduced?
8. Do you think surgery robots reduce this time?

1ª
conversación:
IA generativa
“sintética”



1ª Conversación: Exploratoria sintética y enfocada

π

Hi Pi, this is Eva

Hey Eva! Super happy to meet you I am excited to chat with you and see how I can help. Tell me more about yourself 🌟

I am doing some searching on surgical robots and would like to ask you some questions

Absolutely! I'm a big fan of surgical robots – they've revolutionized the way surgeries are performed. What kind of information are you looking for? I'm happy to answer any questions I can.

Great! Could you tell me what are the main trends for the future in relation to surgical robotics?

Absolutely, Eva! Here are some of the big trends in surgical robotics:

- Miniaturization: Surgeons are looking for smaller and more precise robots that can perform delicate procedures, like brain surgery or eye surgery.
- Artificial Intelligence: Some surgical robots are being designed with AI capabilities, which could allow them to adapt to changes during surgery and even assist the surgeon with decision-making.
- Remote surgery: The ability to perform surgeries from a distance, using robotics and telemedicine, is becoming a reality.

These trends have the potential to revolutionize the way surgery is performed, making it safer, more effective, and more accessible for patients around the world.

1ª Conversación: Exploratoria sintética y enfocada

ChatGPT 3.5

Good morning, could you please tell me what are the main **technological** trends in surgical robotics?

Good morning! As of my last knowledge update in January 2022, the field of surgical robotics has been rapidly advancing, and several trends were shaping its trajectory. Keep in mind that developments may have occurred since then, but here are some main trends up to that point:

1. Minimally Invasive Surgery (MIS): ...
2. Enhanced Precision and Accuracy: ...
3. Telepresence and Remote Surgery: ...
4. Artificial Intelligence (AI) Integration: ...
5. Haptic Feedback: ...
6. Modular Systems: ...
7. Single-Port and Microbot Surgery: ...
8. Surgical Training and Simulation: ...
9. Robotics in Niche Specialties: ...
10. Cost Reduction and Accessibility: ...

1ª Conversación: Exploratoria sintética y enfocada

ChatGPT 3.5

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2. Enhanced Precision and Accuracy: ...
3. Telepresence and Remote Surgery: ...
4. Artificial Intelligence (AI) Integration: ...
5. Haptic Feedback: ...
6. Modular Systems: ...
7. Single-Port and Microbot Surgery: ...
8. Surgical Training and Simulation: ...
9. Robotics in Niche Specialties: ...
10. Cost Reduction and Accessibility: ...

Great, thanks! Could you give me some references related to this?

Certainly! Here are some key references and sources that you can explore to learn more about trends in surgical robotics: (...)

Do you have URLs to these references?

I'm sorry for any confusion, but I currently don't have the capability to provide specific URLs or direct links to external sources, as I don't have real-time internet access.

1ª Conversación: Exploratoria sintética y enfocada

ChatGPT 4

Hi! I am working in a research project, and would like to know what are the main trends in surgical robotics

The field of surgical robotics is rapidly evolving, with several key trends shaping its future. Here are some of the main trends in this area:

1. Miniaturization: ...
2. Enhanced Imaging and Visualization...
3. Artificial Intelligence and Machine Learning: ...
4. Haptic Feedback: ...
5. Telesurgery: ...
6. Autonomous and Semi-autonomous Systems: ...
7. Cost Reduction and Accessibility: ...
8. Collaborative Robots (Cobots): ...
9. Personalized and Precision Surgery: ...
10. Regulatory and Ethical Considerations: ...

These trends reflect the dynamic nature of this field, driven by technological advancements and the ever-increasing demand for improved surgical outcomes. The integration of these technologies promises to transform surgical procedures, making them safer, more efficient, and accessible.

1ª Conversación: Exploratoria sintética y enfocada

Research ChatGPT

Hi! I am working in a research project, and would like to know what are the main trends in surgical robotics

1. Instrument Positioning and Remote Manipulations: ... (Dmitriev & Dashyan, 2022).
2. Market Trends: ... (Sheptunov et al., 2020).
3. Development Towards Smaller, Smarter Devices: ... (Bergeles & Yang, 2014).
4. Increased Degrees of Freedom: ... (Zuo et al., 2022).
5. Minimally Invasive Robots: ... (Jiang et al., 2015).
6. Ultrasound-Based Robotic Platforms: ... (Elek et al., 2017).
7. Expansion to Various Medical Fields: ... (Pushkar, 2012).
8. Advancements in Surgical Tools: ... (Hockstein et al., 2007).
9. Toward Lower Cost, Special Purpose Robots: ... (Gomes, 2011).
10. Haptic Technologies: ... (Enayati et al., 2016).

Hi! I am working in a research project, and would like to know what are the main **technological** trends in surgical robotics **referenced beyond 2020**

1ª Conversación: Exploratoria sintética y enfocada

Research ChatGPT

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9. Toward Lower Cost, Special Purpose Robots: ... (Gomes, 2011).
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**¡Faltan
demasiadas
ideas y
demasiadas
referencias!**

Hi! I am working in a research project, and would like to know what are the main **technological** trends in surgical robotics **referenced beyond 2020**

1ª Conversación: Exploratoria sintética y enfocada

π And do they create any safety issue or disadvantage?

Yeah, it's not all sunshine and rainbows - there are some potential safety risks associated with surgical robots, including:

- Equipment malfunction: Like any technology, surgical robots can malfunction, which could lead to surgical errors or delays.
- Lack of tactile feedback: Surgeons who use robots may have less tactile feedback than those who perform surgery manually, which could lead to errors or complications.
- Overreliance on technology: Surgeons who rely too heavily on robotic technology may lose some of their manual skills and instincts, which could be problematic in emergency situations.

1ª Conversación: Exploratoria sintética y enfocada

ChatGPT 3.5

Ok, thanks! Another question, what are the main safety issues related to surgical robotics?

The use of surgical robotics has introduced new possibilities and advantages in healthcare, but like any technology, it also comes with specific safety considerations. Here are some main safety issues related to surgical robotics:

- 1. Technical Failures:**
 - **Hardware Malfunctions:** Mechanical failures or malfunctions in the robotic system's hardware can potentially compromise the safety of a procedure.
 - **Software Glitches:** Errors in the robotic software, including programming or communication issues, may lead to unexpected behavior during surgery.
- 2. Instrumentation Issues:**
 - **Instrument Failure:** Malfunctions or failures of robotic instruments during a procedure can pose risks to patient safety.
 - **Inadequate Instrument Sterilization:** Ensuring proper sterilization of robotic instruments is crucial to prevent infections.
- 3. System Connectivity and Communication:**
 - **Network Security:** Surgical robots often rely on networks for communication. Securing these networks is essential to prevent unauthorized access or potential cyber threats.
- 4. User Interface Challenges:**
 - **Surgeon Training:** Adequate training is essential for surgeons to operate robotic systems effectively and safely. Inadequate training may lead to errors during surgery.
 - **User Interface Design:** Poorly designed user interfaces can contribute to misunderstandings or mistakes during the operation.
- 5. Lack of Tactile Feedback:**
 - **Haptic Feedback Issues:** The absence or limitations of tactile feedback in some robotic systems may affect a surgeon's ability to perceive tissue characteristics accurately.
- 6. Patient-Specific Factors:**
 - **Anatomical Variations:** Variability in patient anatomy may present challenges for robotic systems, requiring careful preoperative planning and adaptation during surgery.
 - **Patient Positioning:** The patient's position during surgery is crucial, and improper positioning may lead to complications.
- 7. Emergency Situations:**
 - **Emergency Response:** Preparedness for unexpected events or emergencies is crucial. Surgeons and the surgical team should be well-trained in managing unforeseen complications quickly.
- 8. Cost and Resource Considerations:**
 - **Financial Constraints:** The cost of acquiring and maintaining robotic systems may be a barrier for some healthcare institutions. Budget constraints can affect the availability of necessary resources for safe robotic surgery.
- 9. Regulatory Compliance:**
 - **Regulatory Oversight:** Ensuring that robotic systems comply with regulatory standards and guidelines is essential for patient safety. Adherence to safety standards and regular system maintenance are critical.
- 10. Patient Selection and Informed Consent:**
 - **Patient Selection Criteria:** Careful consideration of patient suitability for robotic surgery is essential. Not all patients may be suitable candidates.
 - **Informed Consent:** Proper communication with patients about the risks and benefits of robotic surgery is crucial for obtaining informed consent.

1ª Conversación: Exploratoria sintética y enfocada

ChatGPT 4

Ok, thanks! Another question, what are the main safety issues related to surgical robotics?

1. System Malfunction or Failure: ...
2. Human-Robot Interaction Errors: Miscommunication or misinterpretation ...
3. Cybersecurity Risks: ...
4. Lack of Tactile Feedback: ...
5. Training and Experience of Surgeons: ...
6. Dependency on Electrical Power and Systems: ...
7. Complexity in Emergency Response: ...
8. Patient-Specific Risks: ...
9. Long-Term Reliability and Maintenance: ...
10. Ethical and Legal Concerns: ...

Always 10?

Research ChatGPT

1. Communication and Coordination Failures: ... (Kanji et al., 2021).
2. Defining Safety and Human-Machine Interface Semantics: ... (Fiazza & Fiorini, 2021).
3. Control System Safety Issues: ... (Fodero et al., 2006).
4. Reliability of Telecommunication Channels: ... (Mattos & Caldwell, 2012).
5. Certification and Regulation: Obtaining necessary certifications ... (Gentili et al., 1997).
6. Risk Management in Clinical Trials... (Korb et al., 2005).
7. Safety Incidents Impacting Patients: ... (Alemzadeh et al., 2015).
8. Security as a Safety Requirement: ... (Shah & Nagaraja, 2019).
9. Reducing Errors in the Perioperative Environment: Surgical robotics has the potential to enhance patient safety by reducing and intercepting errors in the perioperative environment (Lai & Louw, 2007).
10. Human Factors Issues: ... (Lai & Entin, 2005).

1ª Conversación: Exploratoria sintética y enfocada

π Great! Going back to times, is it shorter to do a surgery with a robot than the same one done manually?

It really depends on the specific procedure and the surgeon's experience, but in general, robotic surgery can be faster than traditional open surgery. Here are a few reasons why:

- Robots can make more precise movements than the human hand, so they can complete surgical tasks faster and with fewer mistakes.
- Robots can assist with repetitive tasks, freeing up the surgeon to focus on more complex aspects of the procedure.
- Robotic surgery can reduce the need for large incisions, which can save time during the surgery and reduce recovery time after.

That said, there are some procedures where open surgery may still be faster than robotic surgery - so it's not a blanket rule.

ChatGPT 3.5

Ok, thanks! How could time of surgery be reduced with surgery robots?

The use of surgical robots has the potential to reduce the time of surgery through various mechanisms, leveraging the technology's capabilities. **Here are several ways in which surgery robots contribute to more efficient procedures:**
(...)

1ª Conversación: Exploratoria sintética y enfocada

π [Very interesting! Could you share with me the references to this information?](#)

Absolutely! Here are a few sources that can give you more information on this topic:

- "Adverse Events in Robotic Surgery: A Retrospective Study" (PMC4838256) - This study examined adverse events associated with robotic surgery and found that injuries and deaths were relatively common.
- "Diagnosing barriers to safety and efficiency in robotic surgery" (PMC6010349) - This study explored the challenges associated with robotic surgery and found that teamwork and communication were often barriers to safe and efficient surgery.
- "Robotic Surgery: Risks vs. Rewards" (PSNet) - This article provides a comprehensive overview of the risks and benefits of robotic surgery.
- "Safety Issues in Surgical Robotics" (Cdbme) - This article discusses the potential hazards associated with surgical robots and the importance of ensuring their safety.

[Are there URLs where I can find them?](#)

Sure thing! Here are the direct links to the studies I mentioned:



Validación y pre- procesamiento de la información

¿Qué encontramos? ¿Cómo comparamos?

π In which sense would they make it safer?

1 - 0

Persona

Sure thing! Here are some of the ways that surgical robots could make surgery safer:

- Greater precision: Surgical robots can make smaller and more precise movements than the human hand, reducing the risk of mistakes and complications.
- Reducing surgeon fatigue: Robotic surgery can reduce the physical and mental strain on surgeons, leading to fewer errors.
- Increased visualization: Surgical robots are often equipped with high-resolution cameras and advanced imaging systems, giving surgeons a better view of the surgical site and helping them to avoid injury to surrounding tissues.

Enhanced safety protocols: Some surgical robots have built-in safety mechanisms that can detect and prevent errors before they happen, further reducing the risk of complications.

10 minutos netos

Surgical robots provide exceptional precision and control, enabling precise movements and a wide range of maneuvers that exceed the capabilities of the human hand. In addition, they enhance visualization through advanced cameras that provide magnified three-dimensional views of the operating area, which is particularly valuable in delicate and complex surgeries. These systems also facilitate minimally invasive surgeries, resulting in fewer complications, less pain, shorter hospital stays and faster recovery. Ultimately, surgical robots elevate the quality of surgical outcomes by providing surgeons with a level of precision and control that is especially beneficial in complex procedures that require delicate manipulations that might be difficult to perform with conventional techniques.

40 minutos

¿Qué encontramos? ¿Cómo comparamos?

π Very interesting! Could you share with me the references to this information?

0 - 1

Persona

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- "Robotic Surgery: Risks vs. Rewards" (PSNet) - ...
- "Safety Issues in Surgical Robotics" (Cdbme) - ...

1995, 2016 y 2018

A prospective cohort study of the accuracy and safety of robot-assisted minimally invasive spinal surgery - PubMed (nih.gov)

Preliminary study of the accuracy and safety of robot-assisted mandibular distraction osteogenesis with electromagnetic navigation in hemifacial microsomia using rabbit models | Scientific Reports (nature.com)

2022

¿Qué encontramos? ¿Cómo comparamos?

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Absolutely! Here are a few sources that can give you more information on this topic:

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1995, 2016 y 2018

A prospective cohort study of the accuracy and safety of robot-assisted minimally invasive spinal surgery - PubMed (nih.gov)

Preliminary study of the accuracy and safety of robot-assisted mandibular distraction osteogenesis with electromagnetic navigation in hemifacial microsomia using rabbit models | Scientific Reports (nature.com)

2022

Veracidad vs Actualidad

¿Qué encontramos? ¿Cómo comparamos?

ChatGPT

Puedes editar las preguntas

Veracidad vs Relevancia y Actualidad

**Para tratar de completar durante las 2^{as}
búsquedas**

**Research ChatGPT te da pistas muy rápidas
sobre posibles fechas de tendencias**



2as conversaciones y Cruce de IAs

2ª Conversación: Profundizando

π Hi Pi! Remember when I asked you about surgical robots? Hi there! Oh yes, I remember - surgical robots are super fascinating... Tell me more about what you're interested in regarding surgical robots!

I asked you if they created any safety issue or disadvantage, and you gave me some insights. You gave me 4 references, of which you prepared a general summary with trends such as equipment malfunction. Could you please tell me more specific safety issues identified by these sources?

Sure thing, happy to dig into the specifics. Here's a quick summary of the safety issues that the sources discussed:

- Equipment malfunction, as you mentioned: this can include issues with the robot's arms, cameras, or other components, which can potentially lead to surgical errors.
- Lack of tactile feedback: since surgical robots are operated remotely, surgeons can't feel the tissue they're working with, which can make it challenging to gauge the amount of pressure they need to apply.
- Surgical site infection: while the risk of infection is lower with robotic surgery than with traditional open surgery, it can still occur.

- Equipment malfunction: Like any technology, surgical robots can malfunction, which could lead to surgical errors or delays.
- Lack of tactile feedback: Surgeons who use robots may have less tactile feedback than those who perform surgery manually, which could lead to errors or complications.
- Overreliance on technology: Surgeons who rely too heavily on robotic technology may lose some of their manual skills and instincts, which could be problematic in emergency situations.

2ª Conversación: Profundizando

π Great, thanks. The references you gave me are dated 1995, 2016 and 2018; don't you find any more updated ones?

You're quite right, those references are a bit dated now. I did some digging and found some more recent research on the topic. Here are some of the findings:

- Cybersecurity is becoming a bigger concern, as surgical robots are increasingly connected to networks and vulnerable to cyber attacks.
- Docking the robotic system, which involves connecting the robot to the patient, can be a barrier to safety and efficiency.

Overall, robotic surgery is generally considered safe, but like any surgical procedure, there are some risks to consider.

Could you give me the link to the new references?

Sure! Here are a few links to the recent studies I mentioned:

Integrando IAs

Final

These are most relevant safety risks associated with surgical robots today:

- **Equipment malfunction:** Like any technology, surgical robots can malfunction, which could lead to surgical errors or delays.
 - Hardware Malfunctions.
 - Software Glitches.
 - Instrument Failure.
- **Lack of tactile feedback:** Surgeons who use robots may have less tactile feedback than those who perform surgery manually, which could lead to errors or complications. Since surgical robots are operated remotely, surgeons can't feel the tissue they're working with, which can make it challenging to gauge the amount of pressure they need to apply.
- **Cybersecurity** is becoming a bigger concern, as surgical robots are increasingly connected to networks and vulnerable to cyber attacks.
- **Docking the robotic system**, which involves connecting the robot to the patient, can be a barrier to safety and efficiency.
- **The potential for the robot to move faster than the surgeon can control**, which can result in injuries to the patient or damage to surrounding tissue.
- **The risk of "runaway robot" events**, where the robot moves unexpectedly, potentially causing harm to the patient or the surgical team.
- **User Interface Challenges:** Poorly designed user interfaces can contribute to misunderstandings or mistakes during the operation.
- **Complexity in Emergency Response**

2ª Conversación: Profundizando

π About the learning curve for using a surgery robot:

Estimates on how long does it take today vary, but it can take anywhere from several months to a year or more for a surgeon to become fully proficient in robotic surgery. Here are some estimates from research papers:

- A 2014 study found that it took an average of about 28 cases for surgeons to reach proficiency in robotic-assisted gastric bypass surgery.
- A 2020 study found that it took an average of 43 cases for surgeons to reach proficiency in robotic-assisted colectomy.

However, it's important to note that proficiency in robotic surgery is not just about the number of cases performed - it also involves developing the right skills and techniques, building confidence and becoming comfortable with the technology.

ChatGPT 3.5

Some studies suggest that after approximately 20 to 50 cases, surgeons may reach a plateau in their learning curve, demonstrating improved efficiency and outcomes. However, ongoing practice and experience continue to refine skills over time.

Uso de la información



5.1 Tirando del hilo

Shah, S.K., Felinski, M.M., Wilson, T.D., Bajwa, K.S., Wilson, E.B. (2021). Next-Generation Surgical Robots. In: Atallah, S. (eds) Digital Surgery. Springer, Cham.

https://doi.org/10.1007/978-3-030-49100-0_30

Y. Chen *et al.*, "The SHURUI System: A Modular Continuum Surgical Robotic Platform for Multiport, Hybrid-Port, and Single-Port Procedures," in *IEEE/ASME Transactions on Mechatronics*, vol. 27, no. 5, pp. 3186-3197, Oct. 2022, doi: 10.1109/TMECH.2021.3110883.

Bergholz, M., Ferle, M. & Weber, B.M. The benefits of haptic feedback in robot assisted surgery and their moderators: a meta-analysis. *Sci Rep* **13**, 19215 (2023).

<https://doi.org/10.1038/s41598-023-46641-8>

En total... ¿3 horas?

Brainstorming

Dear partners,

As you know, I am working on putting LABWAVE upside down 😊

One of the first steps is to study the technological area so that what we propose is specific and relevant and, at the same time, "unquestionable" in a boiling area as AI. In order to do this study, I have been chatting with Pi.ai and ChatGPT about the project.

Find attached my working document. In a first section I have prepared myself a list of starting questions, and then is the dialogue with Pi.ai and, finally, ChatGPT. Could you please have a look at the document and tell me:

1. What are your opinions about this info?
2. What are your main conclusions?
3. Is there anything you would like to reshape in relation to your planned R&D efforts during LABWAVE?
4. Is there any particular information source you think we should be taking into account?

You could send me direct answers to these questions or include edits / comments in the document itself, whatever is best for you. If you edit the document, please keep track of changes. It would be great to have your answers by 18/12.

Thanks!, Eva.

A high-angle, top-down view of a diverse group of business professionals sitting around a large, round, light-colored wooden table. They are engaged in a meeting, with some pointing at documents or laptops on the table. The scene is dimly lit, with a blue and grey color palette. The text '¡Gracias!' is centered in the middle of the image.

¡Gracias!

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