Spark Facebook for Cloud Brain Computer Interface

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Welcome

My brain is only a receiver, in the Universe there is a core from which we obtain knowledge, strength and inspiration. I have not penetrated into the secrets of this core, but I know that it exists.

Nikola Tesla

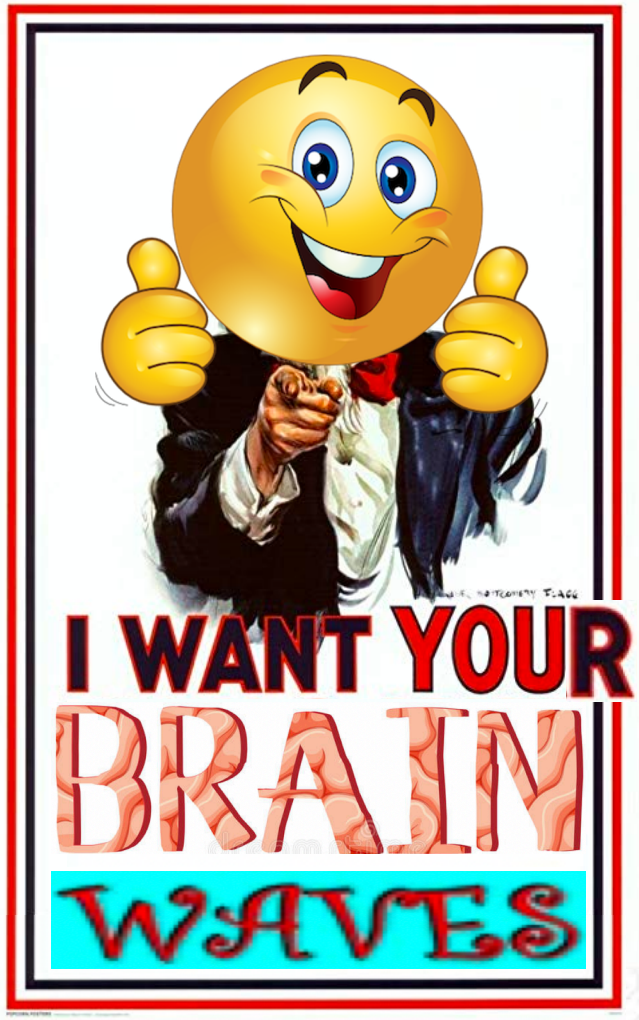
Dr Cavalcanti

a/k/a Dr. Color Candy or Dr. C

coolwallpapers.net

Facebook

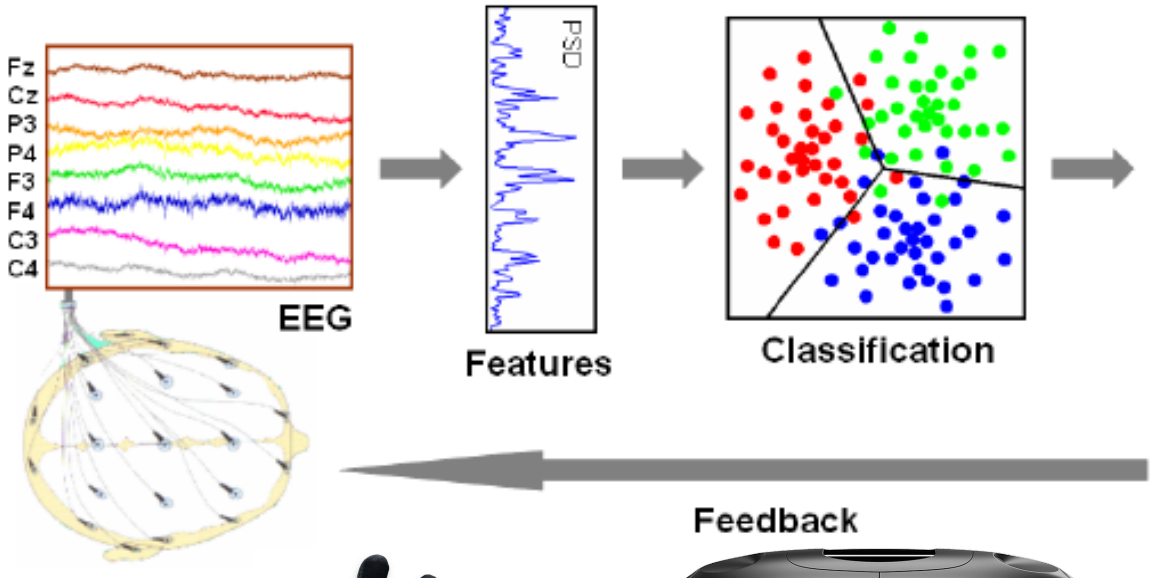
Brain Computer Interface



BCI SOCIETY

Project: Brain Computer Interface for Avatar Robotics

You are formally invited to join this study by donating your brain waves



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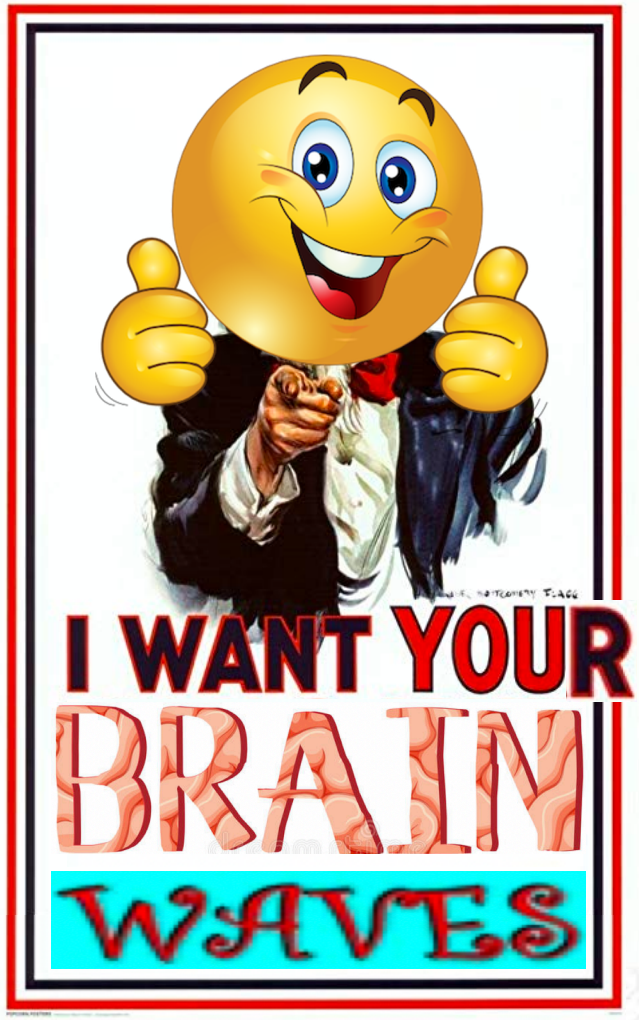
BCI.cwu@gmail.com



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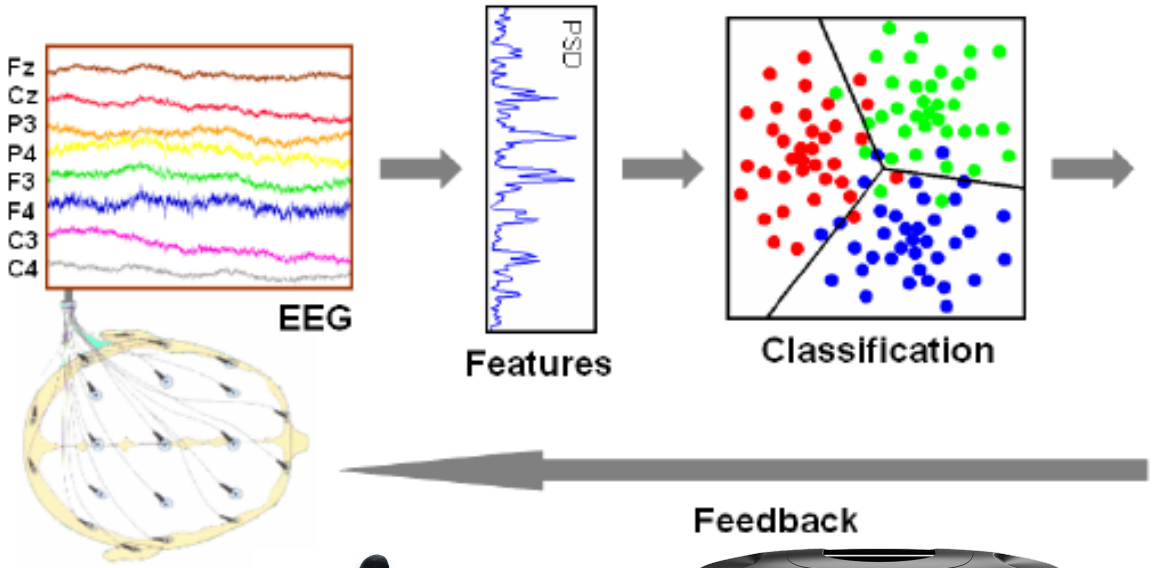

Control of devices

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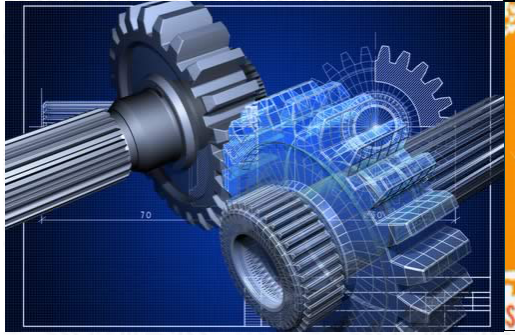
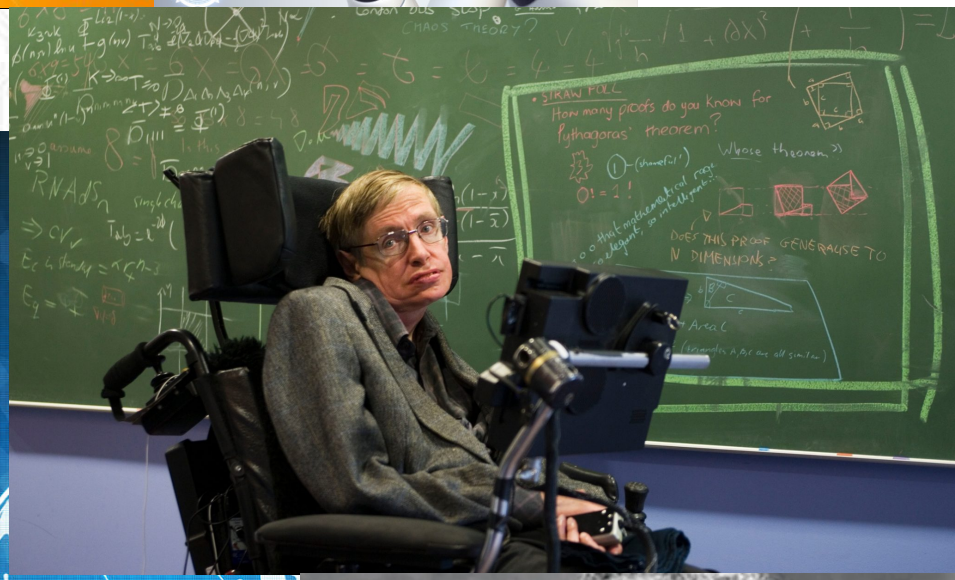
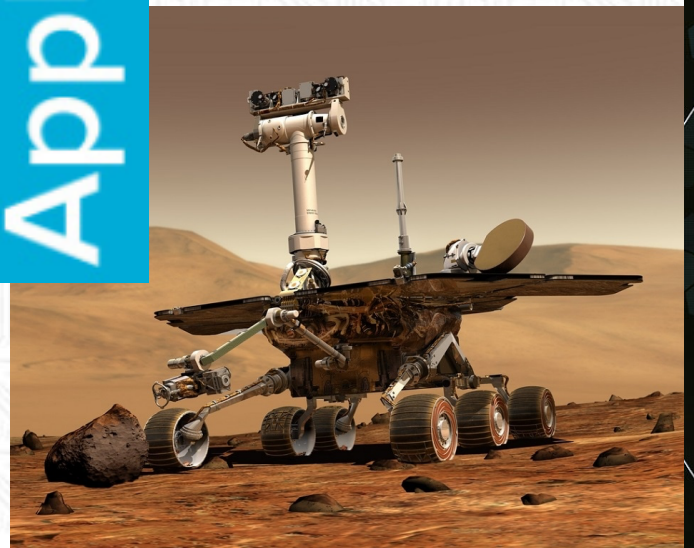


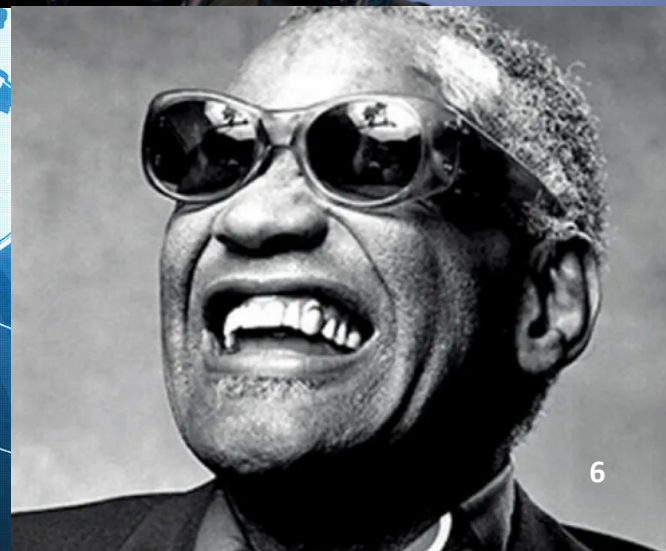
MOTIVATION

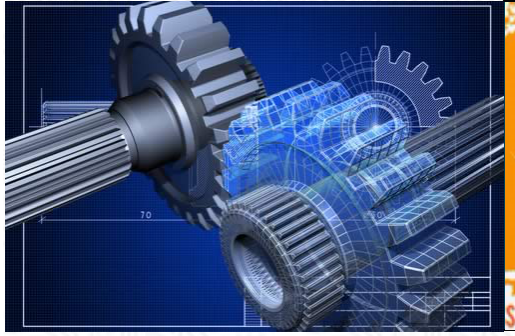
Applications

- Visually Impaired
- Quadriplegia
- Cyberspace Exploration
- Mission Critical



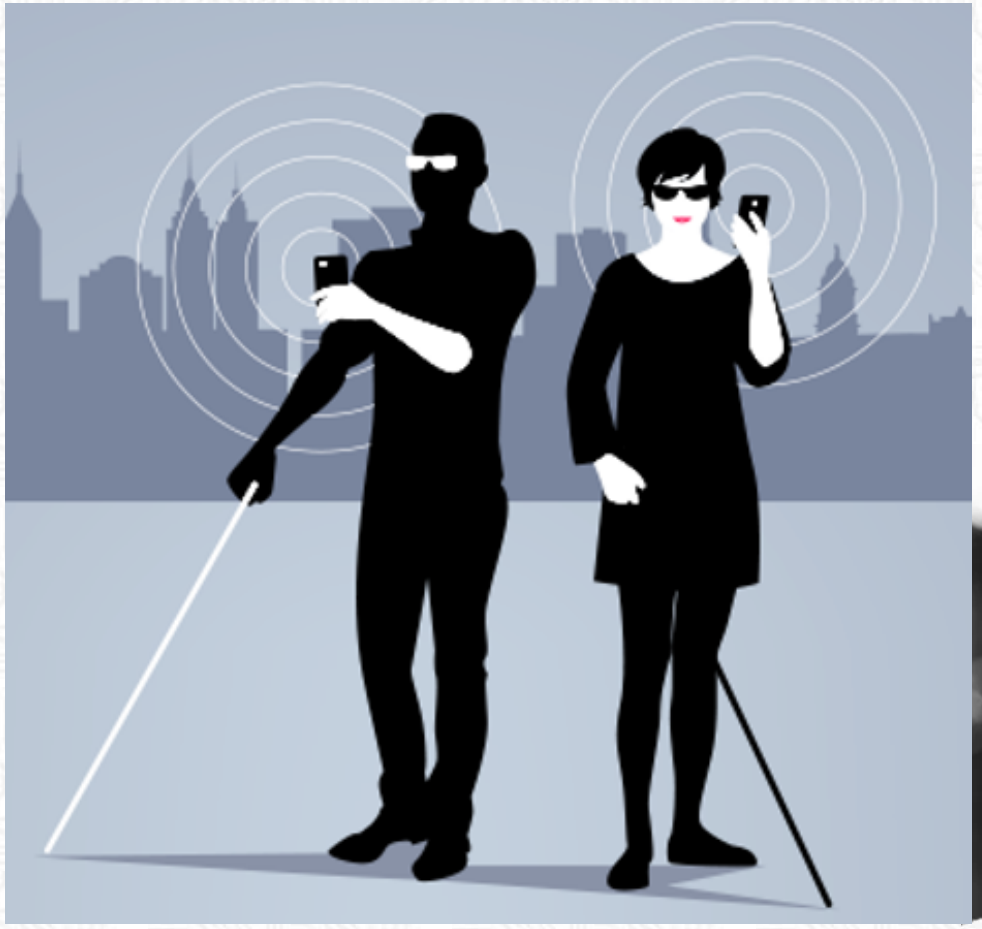




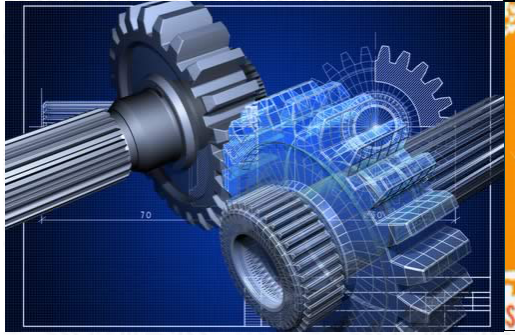


Disability: visually impaired

Applications



Ref. https://gcn.com/articles/2019/09/23/smart-cities-visually-impaired.aspx

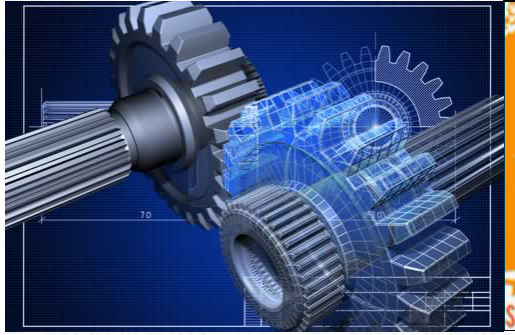


MOTIVATION

Disability: visually impaired

Applications

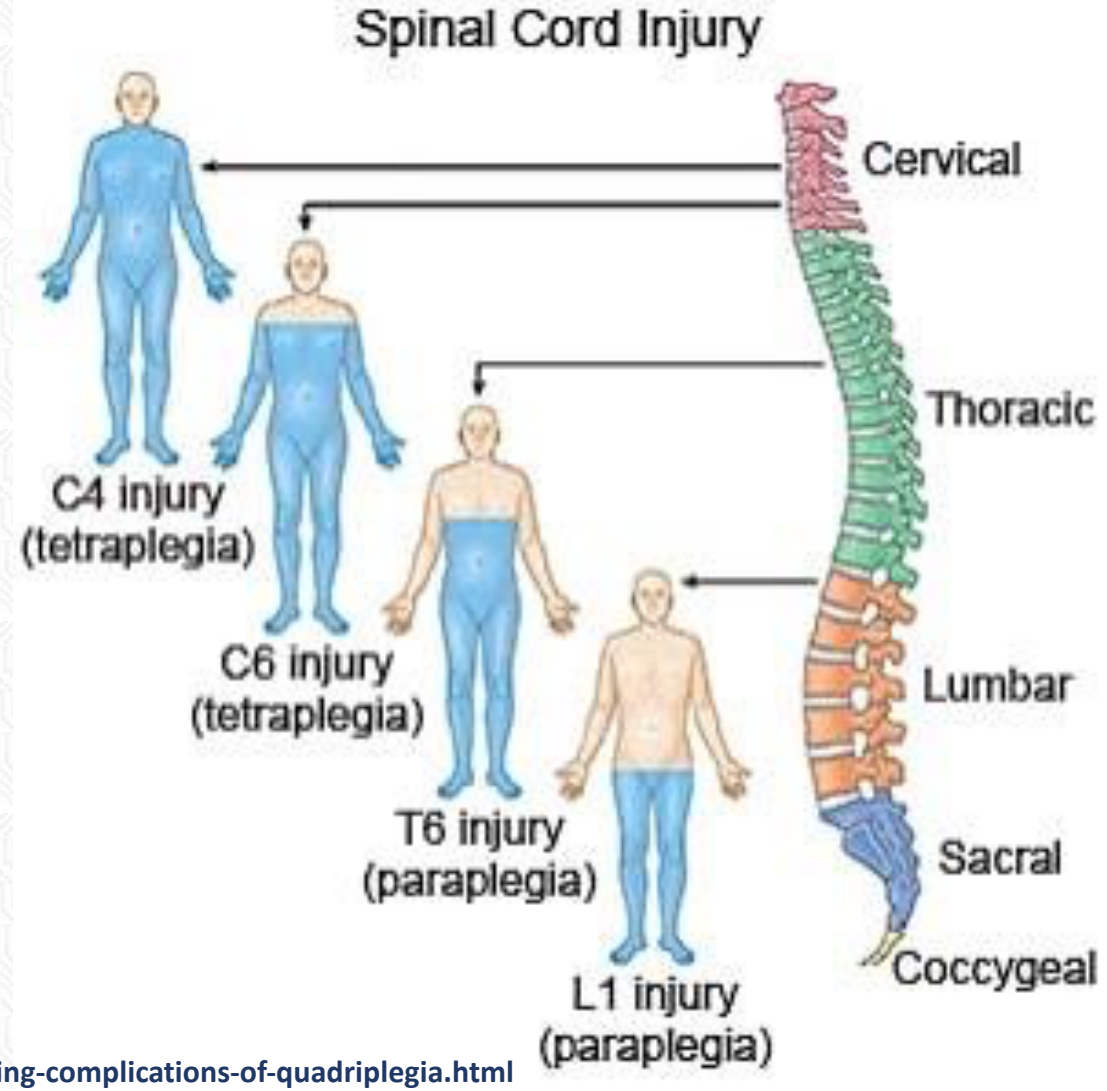
Ref. https://tecoreviews.com/reviews/6-best-screen-readers-for-the-blind-or-visually-impaired-people



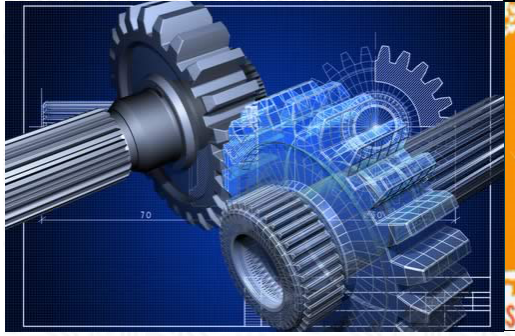
MOTIVATION

Applications

Disability: quadriplegia



Ref. https://www.healthproductsforyou.com/ar-overcoming-complications-of-quadriplegia.html

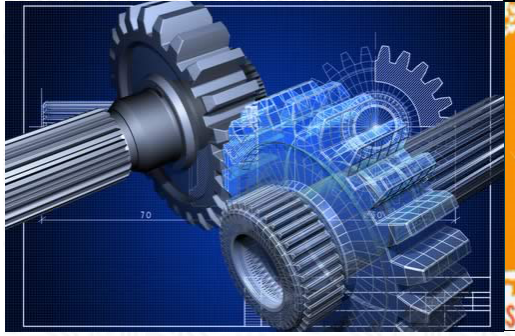


MOTIVATION

Disability: quadriplegia

Applications

The Upside (2017)

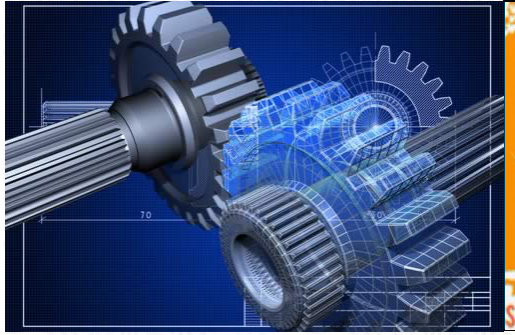


MOTIVATION

Cyberspace Exploration

Applications

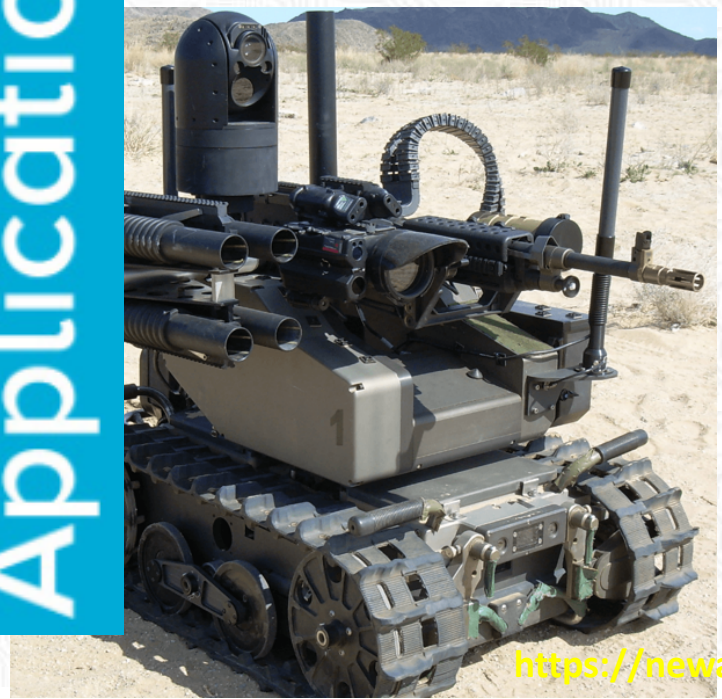
Ref. https://sociable.co/technology/brain-computer-interface-brainwave-patterns-speech

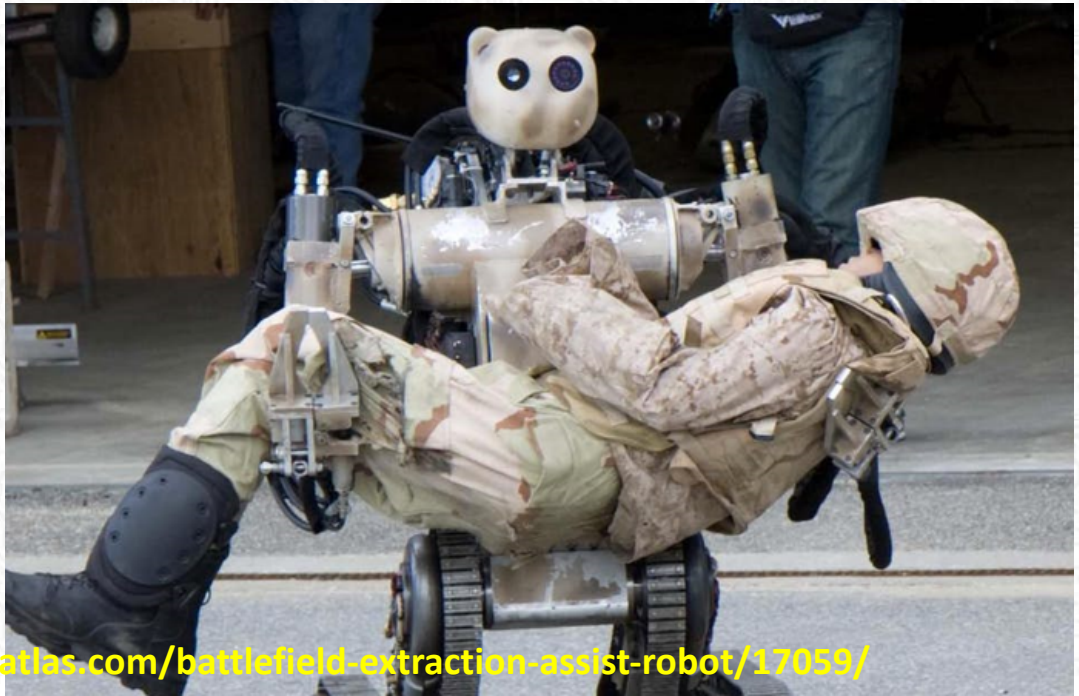


MOTIVATION

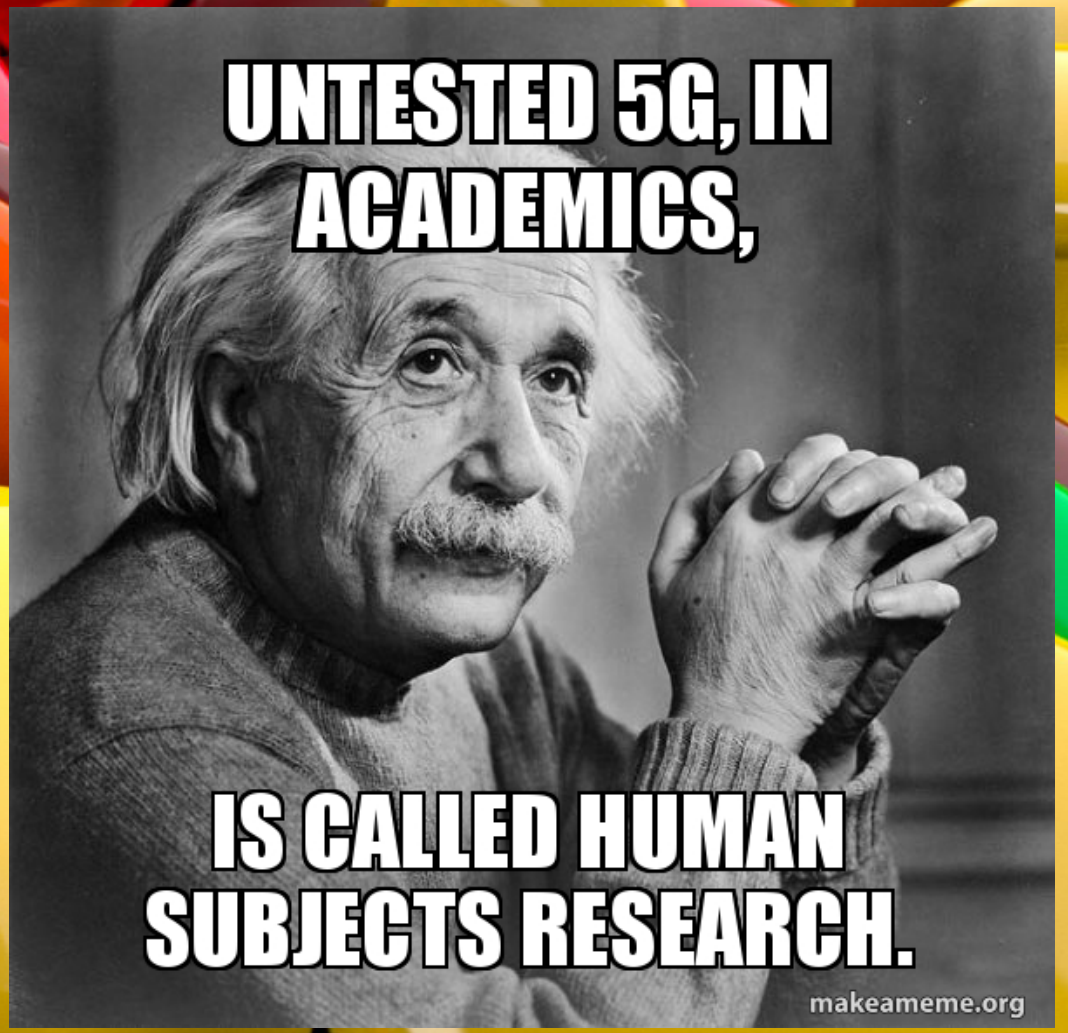
Mission Critical: Homeland security

Applications





https://newatlas.com/battlefield-extraction-assist-robot/17059/



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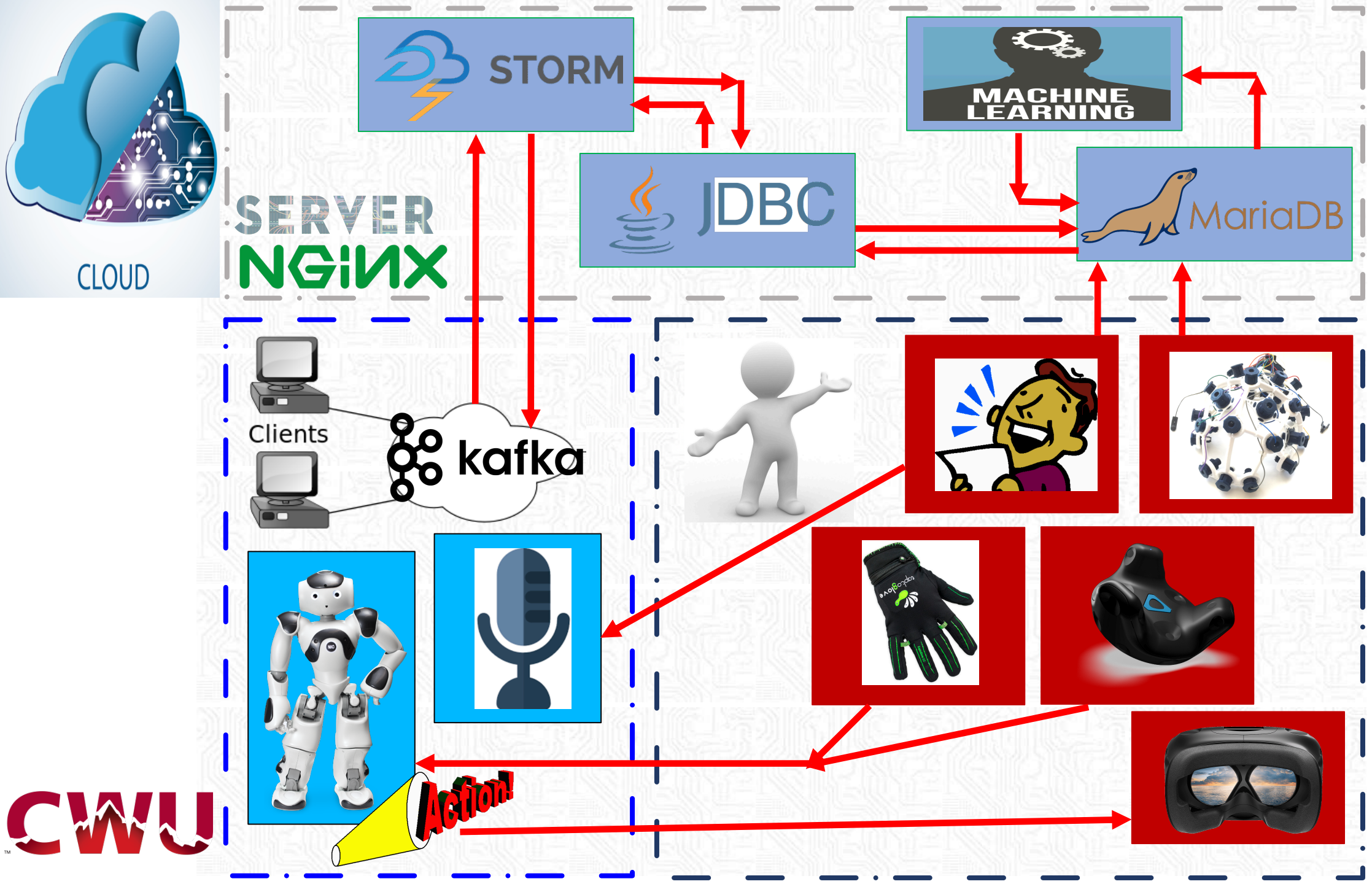
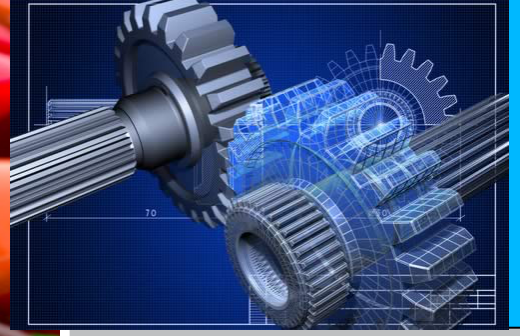
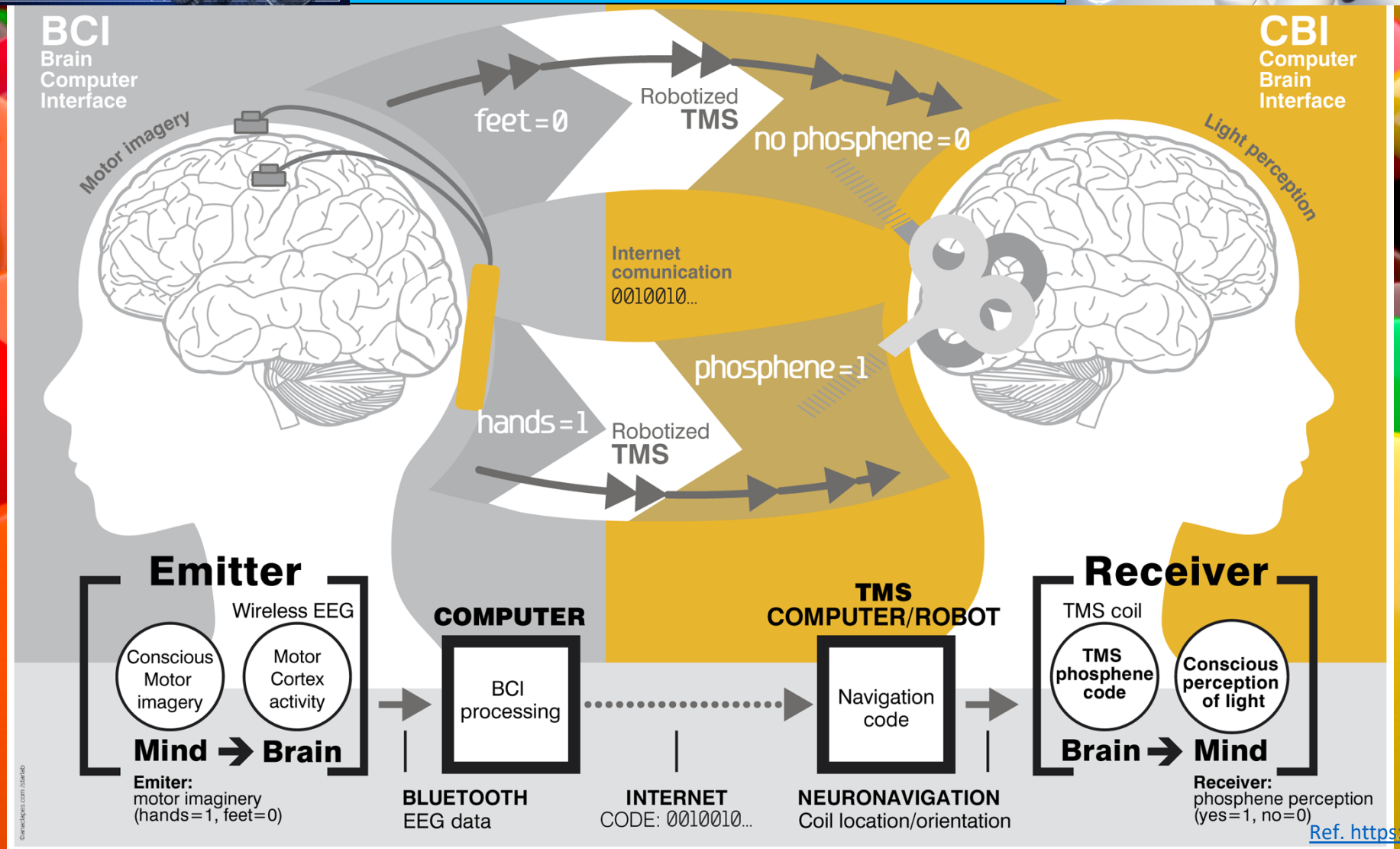
Data Collection Challenges

- Human Subject Approval
- Time consuming
- Attention to detail


CLOUD
STORM
MACHINE LEARNING
SERVER
NGINX
JDBC
MariaDB
Clients
kafka
Action!



Brain Computer Interface



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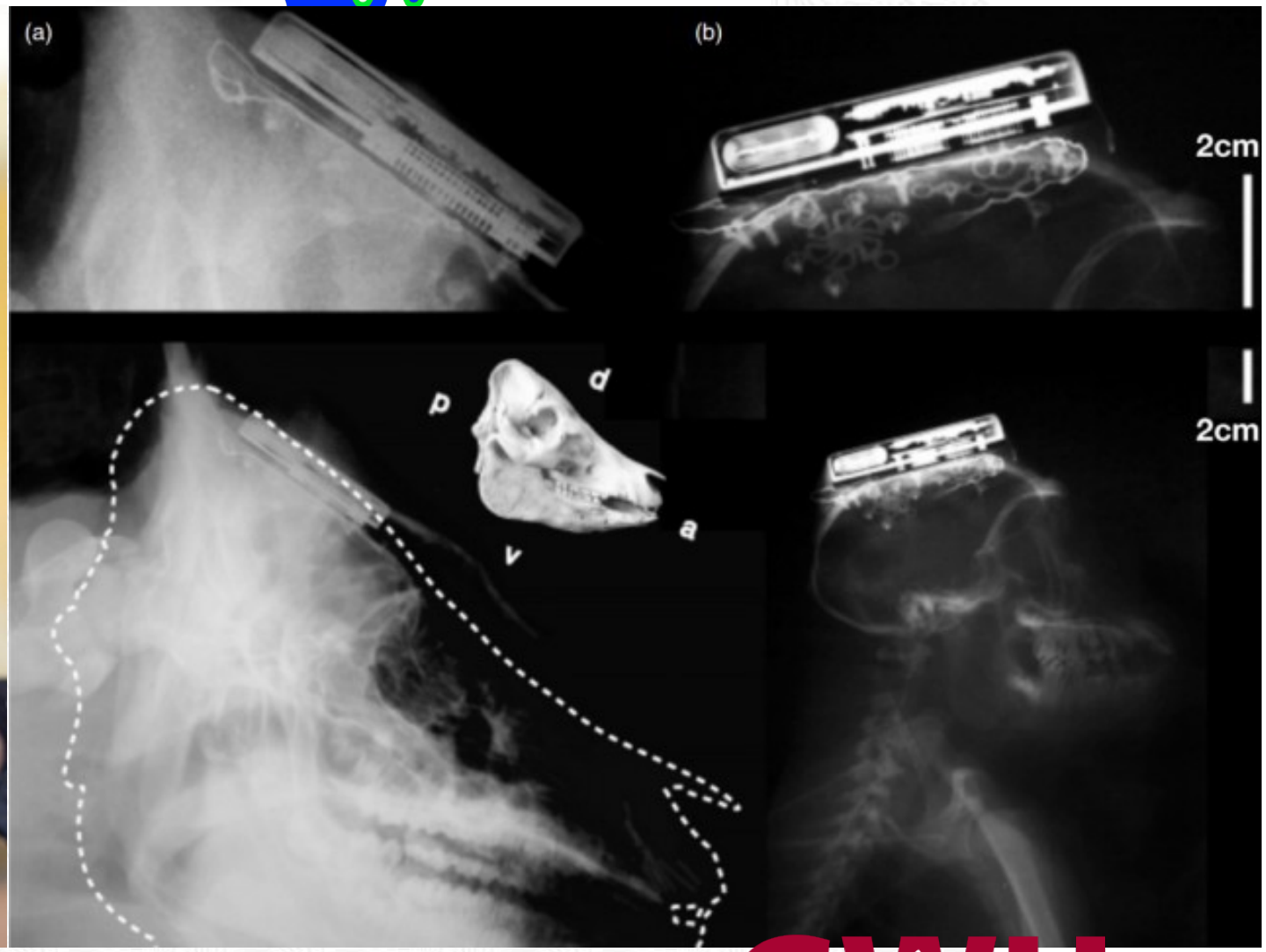
Ref. https://biohackinfo.com/telepathy

FIRST! BCI

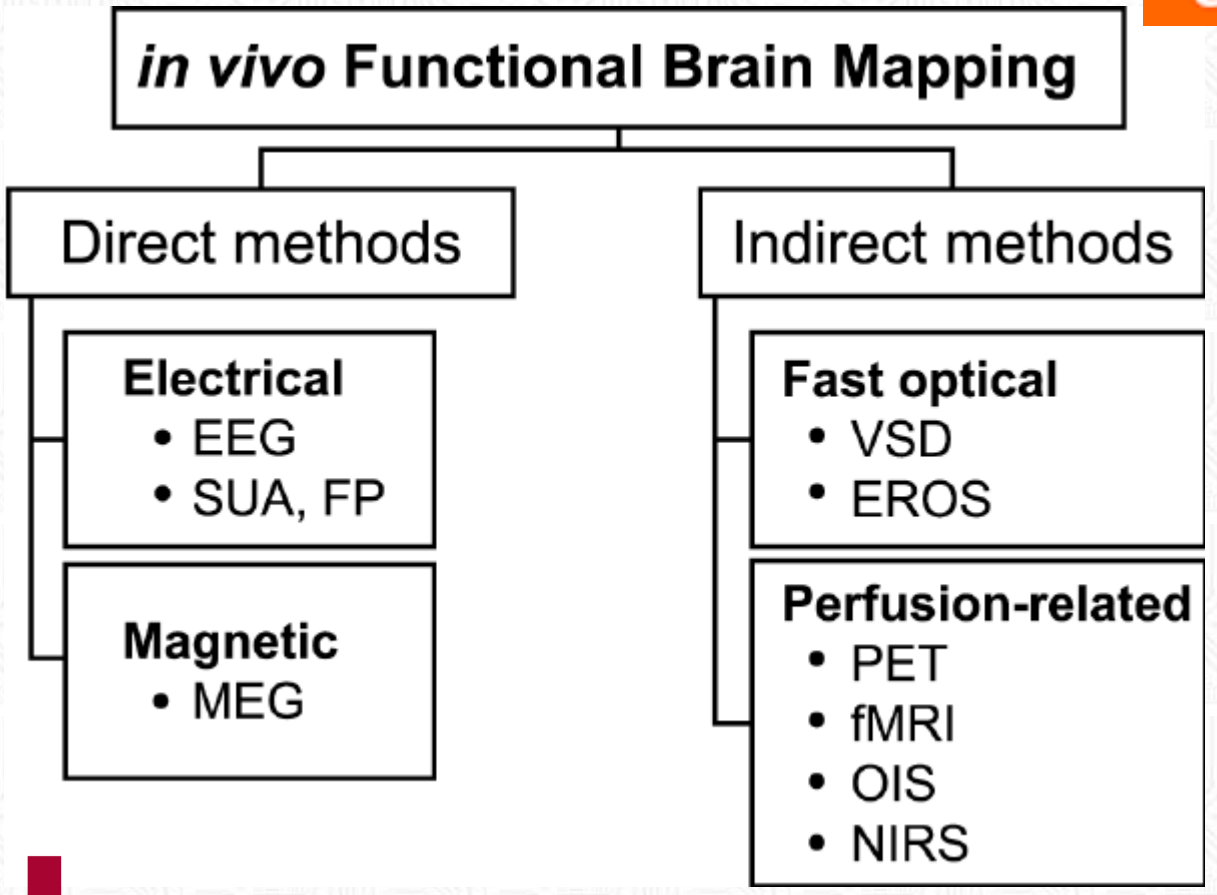


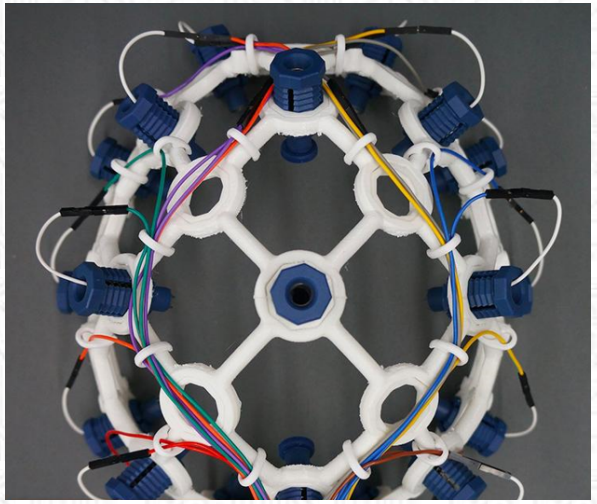
Ref. https://www.extremetech.com/extreme/149879-brown-university-creates-first-wireless-implanted-brain-computer-interface

CURRENTLY...

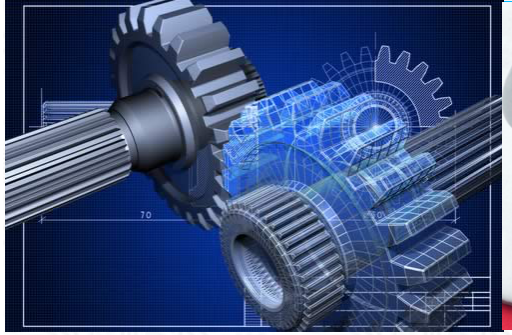
NON INVASIVE
Continuous non invasive

EEG Brain Gate





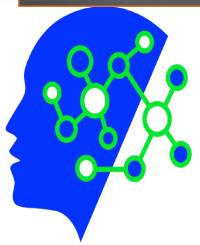
Ref. https://www.wareable.com/wearable-tech/muse-brain-sensing-headband-review-938



pandas

$$y_{it} = \beta' x_{it} + \mu_i + \epsilon_{it}$$

ARROW

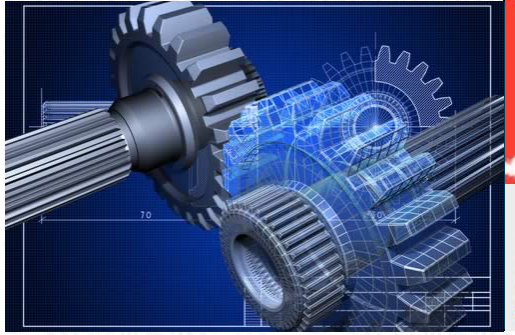


BCI SOCIETY

TensorFlow

APACHE Spark™

Example (BCI Interacting with NAO)



Cloud Computing

AWS vs. Azure vs. Google

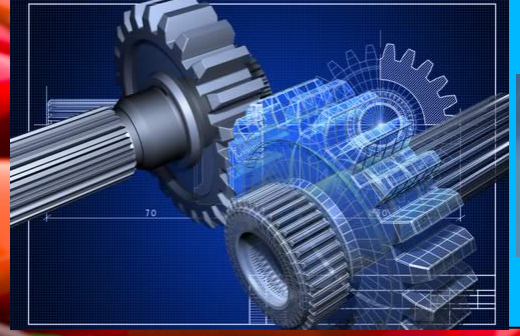
In comparison to Google Cloud Platform vs AWS vs Microsoft Azure, Pricing is the key factor to look upon. Google Cloud Platform provides 12-month free trial service. After this period, a user can quit all the services if not required or can update if he/she wants to change the current plan. But in other platforms, Pricing is a bit high.

Google Cloud

VPS.NET

DigitalOcean

Ref. https://www.whizlabs.com/blog/google-cloud-hosting/



Spark Facebook

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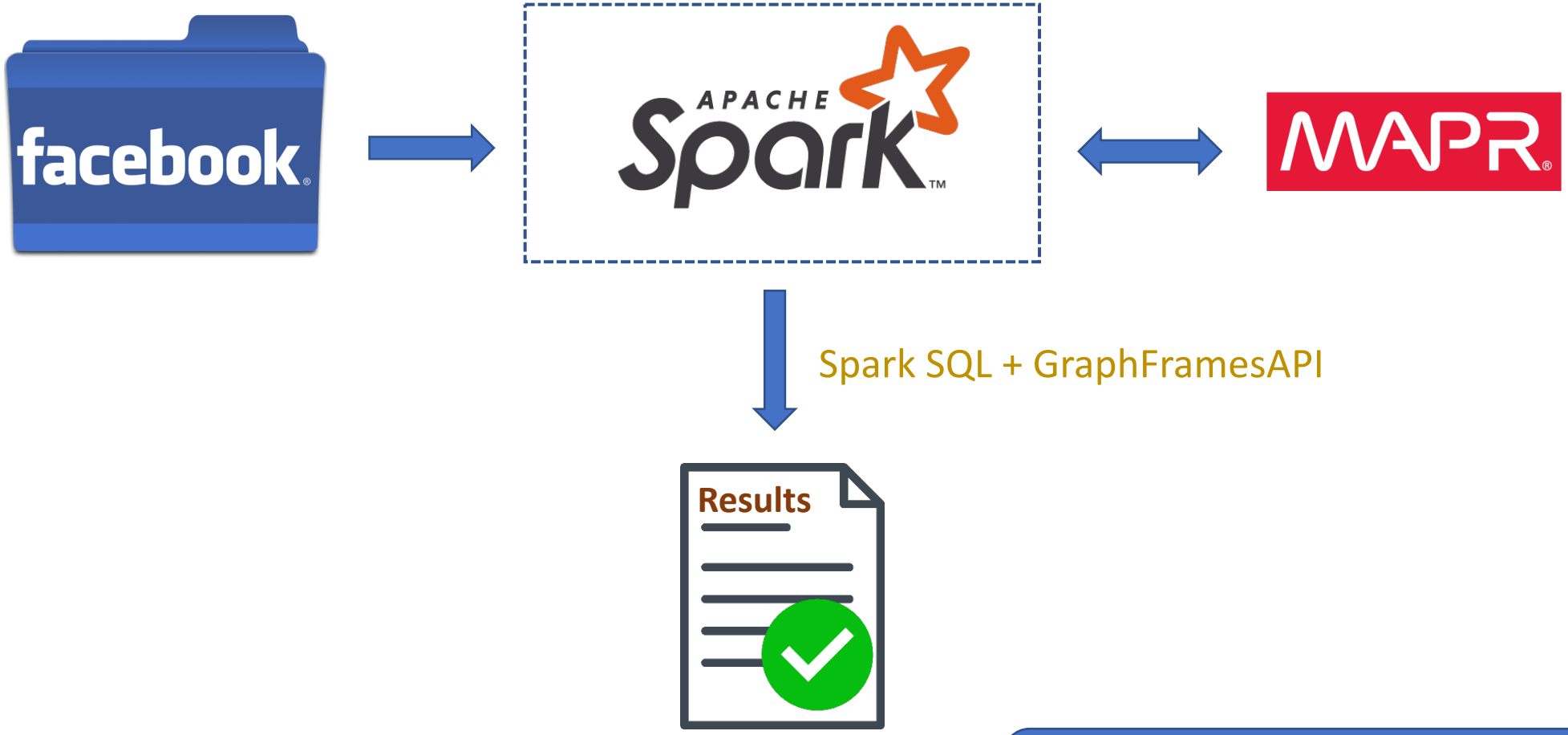
Spark: Context Setting

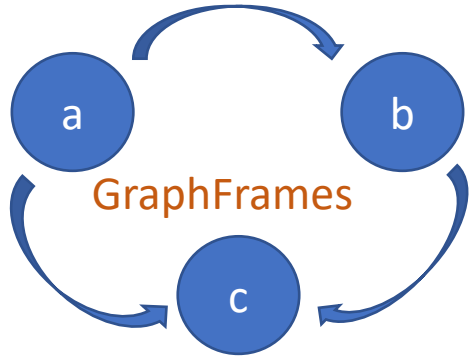
Spark Facebook



Query Facebook Data – Max Common Friends

- Python Code:

```
print("get common friends")
# c = common friend of a and b
commonf = g.find("(a)-[]->(b); (b)-[]->(c); (a)-[]->(c)").select(F.col("a.id").alias("a"),\
          F.col("b.id").alias("b"),F.col("c.id").alias("common"))
commonf = commonf.groupBy("a","b").count()
commonf = commonf.groupBy("a").agg(F.max("count")).orderBy("a")
sqlContext.clearCache()
commonf.show(30)
```



- Result:

a	max(count)
0	69
1	8
10	7
100	6
1000	7
1001	12
1002	2
1003	71
1004	95
1005	9
1006	100
1007	6
1008	1
1009	34
101	10
1010	18
1011	24
1012	8
1013	2
1014	52

Max Common Friends for Each Person ID

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Spark Facebook

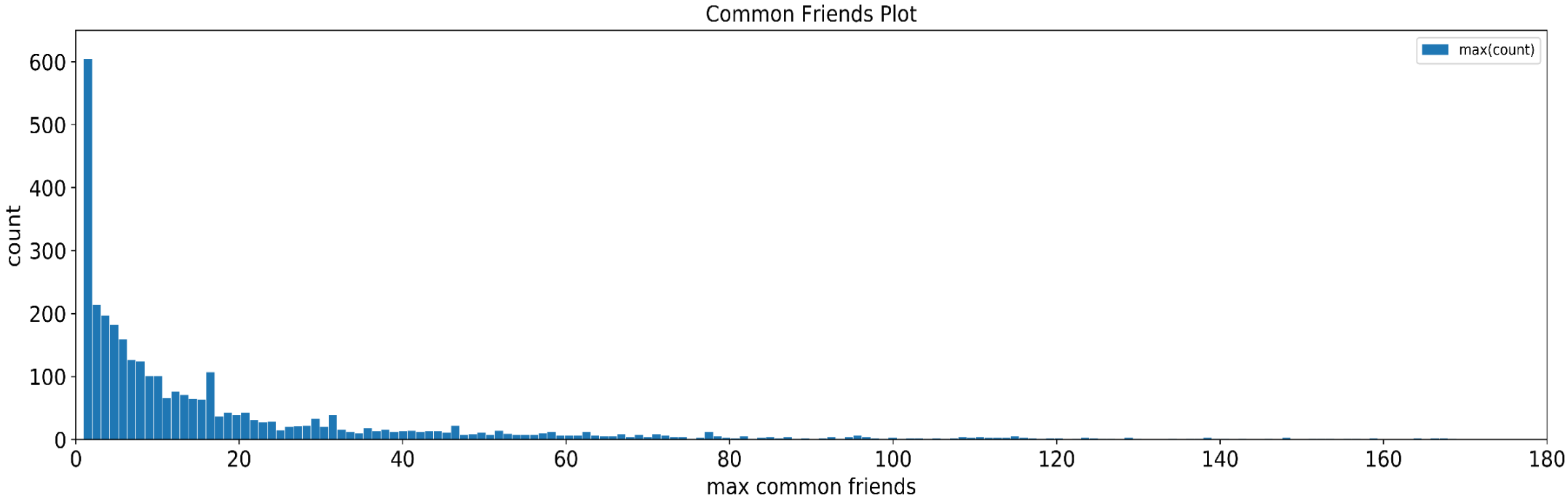
Query Facebook Data – Histogram

Spark Facebook

- Python Code:

```
import matplotlib
import matplotlib.pyplot as plt
pd = commonf.toPandas()
pd[['max(count)']].plot(kind='hist', bins=200,fontsize=15,
                        xlim=(0,180),ylim=(0,650),width=1,figsize=(20,5))
plt.title("Common Friends Plot",fontsize=15)
plt.xlabel('max common friends',fontsize=15)
plt.ylabel('count',fontsize=15)
plt.savefig('output12.png',dpi=500)
```

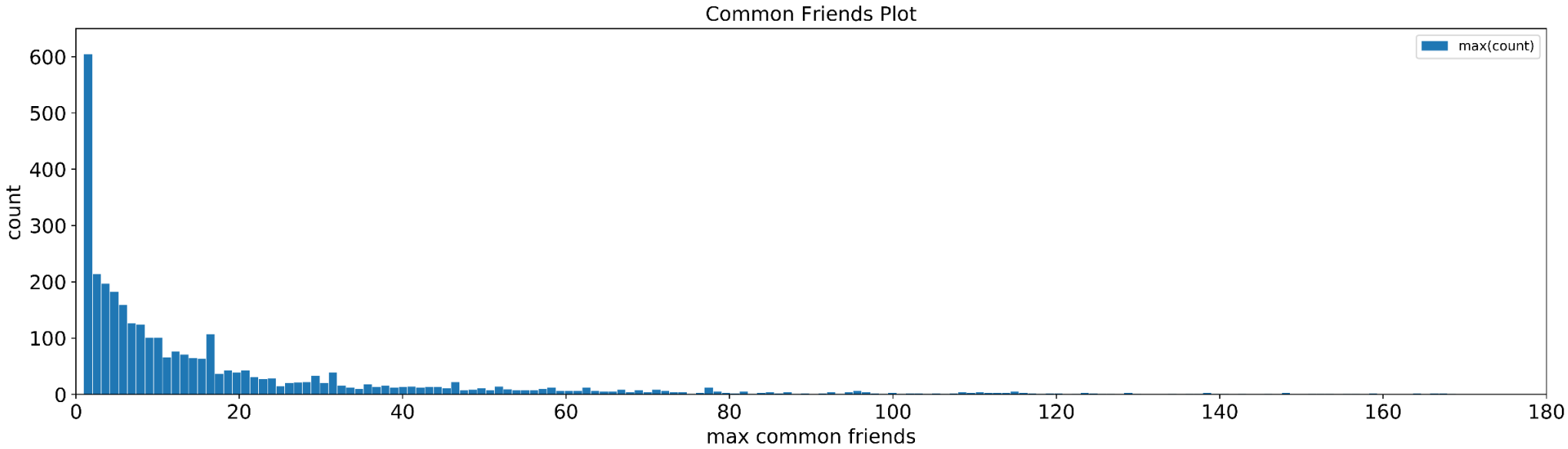
- Result:



Query Facebook Data – Histogram

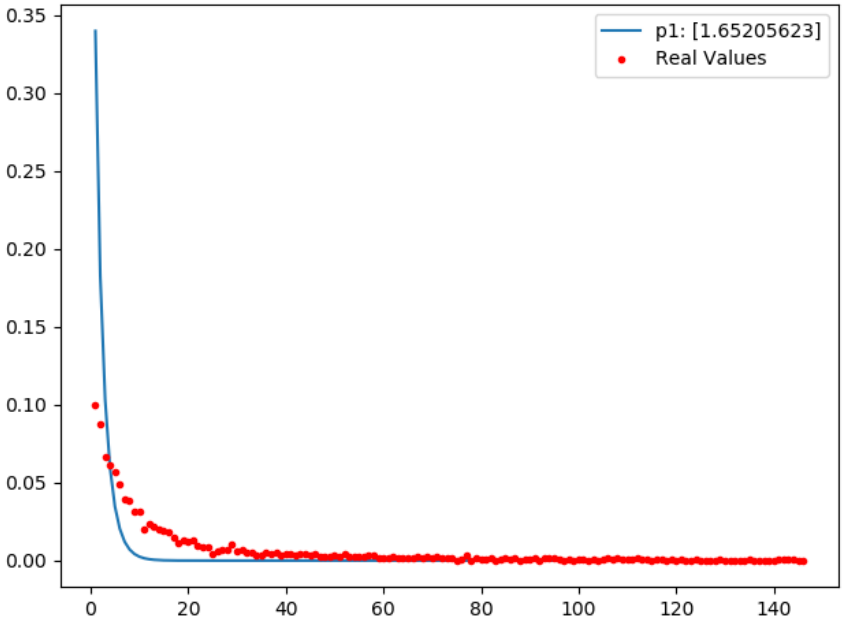
Spark Facebook

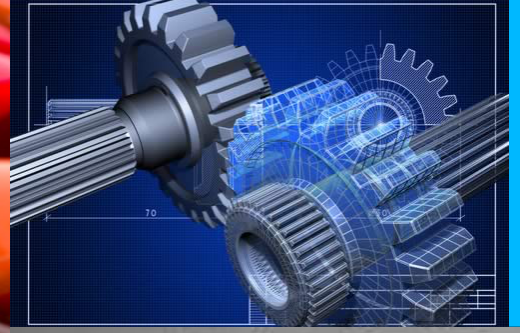
- Origin Data:



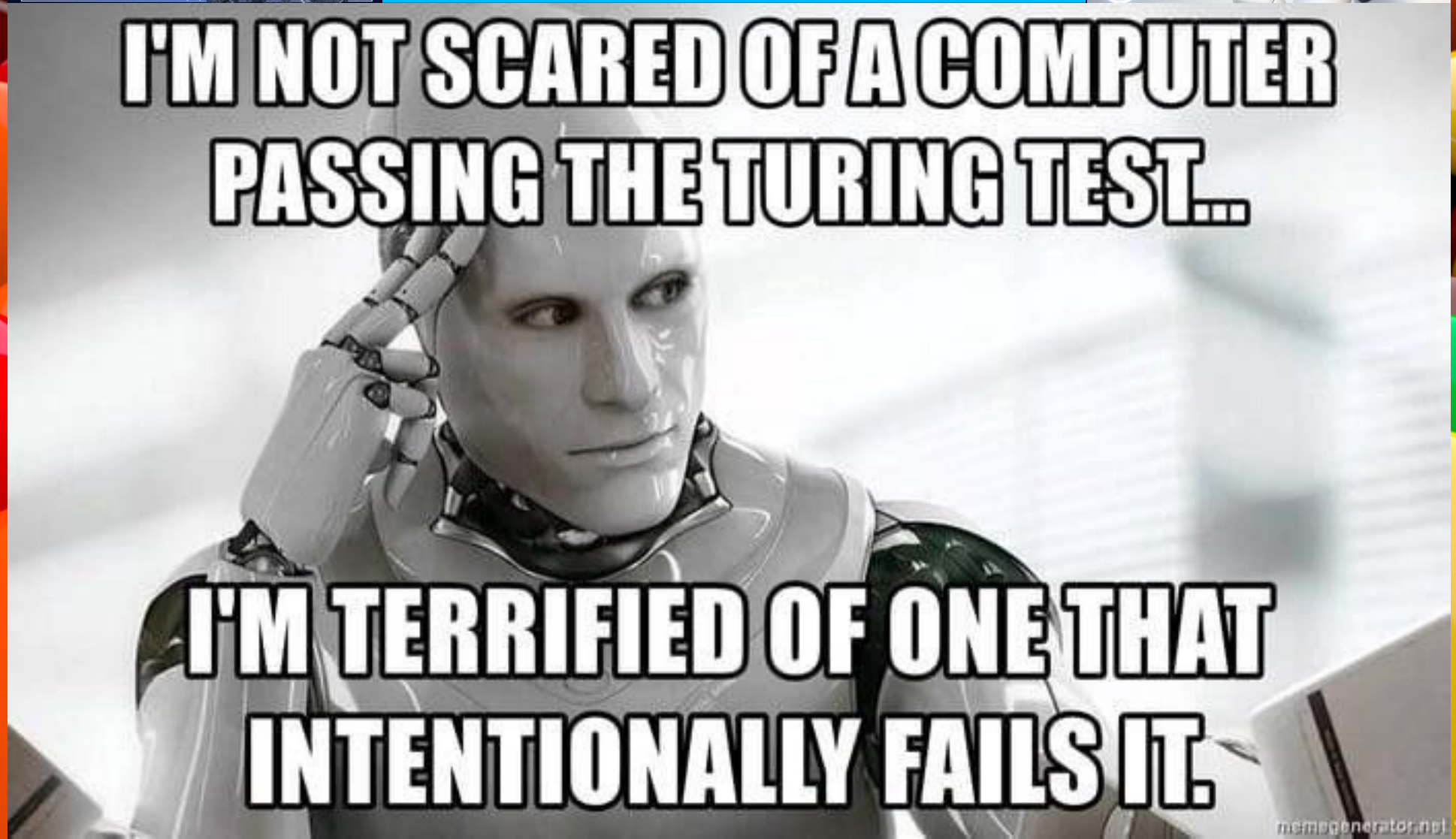
- Curve Fitting: Chi-square Distribution

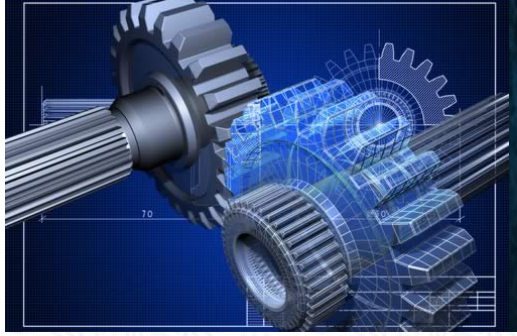
$$f(x;\,k) = \begin{cases} \dfrac{x^{(k/2-1)}\,e^{-x/2}}{2^{k/2}\Gamma\left(\frac{k}{2}\right)}, & x > 0; \\ 0, & \text{otherwise.} \end{cases}$$





Machine Learning





CONCLUSION

a. Cyber-physical Humanoid Robotic Avatar

Is a relatively new area of growing interest

b. Applications

Disability / Mission Critical

Cyberspace exploration

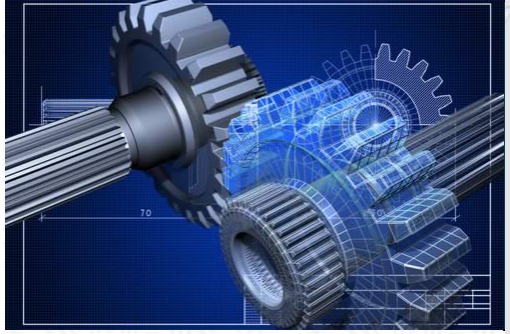
c. Cloud Computing/Big Data

Allow scalability for immersive IoT Avatars

Contributions

→ New architecture platform for Cyberphysical avatars

→ Integrate cloud computing and big data for avatars



Financial support to this project

CWU for providing the necessary tools

Thank You!

BCI Team

Holly Strauch, Jacky Chen, JuneYeob Lee,
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Bryce Harmsen, Aleisha Sebastian, Guzel Rakhimova

CS565 Scientific Computing

Andrew Dunn, Justin Phan Phan

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