Artificial intelligence for the safe use of medications during breastfeeding

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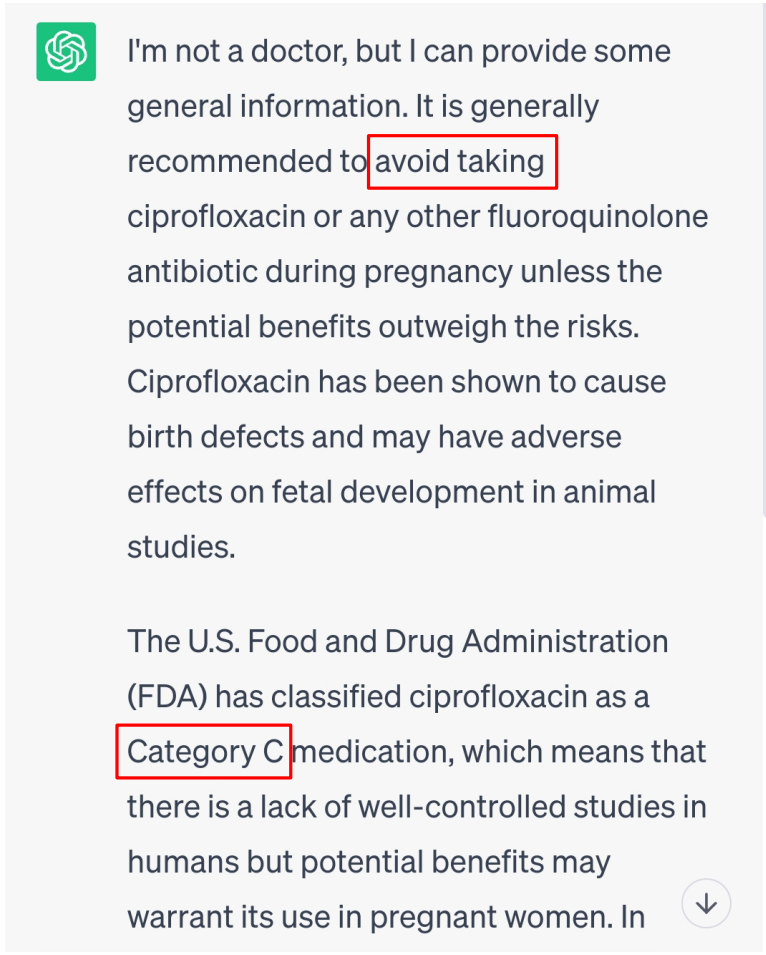
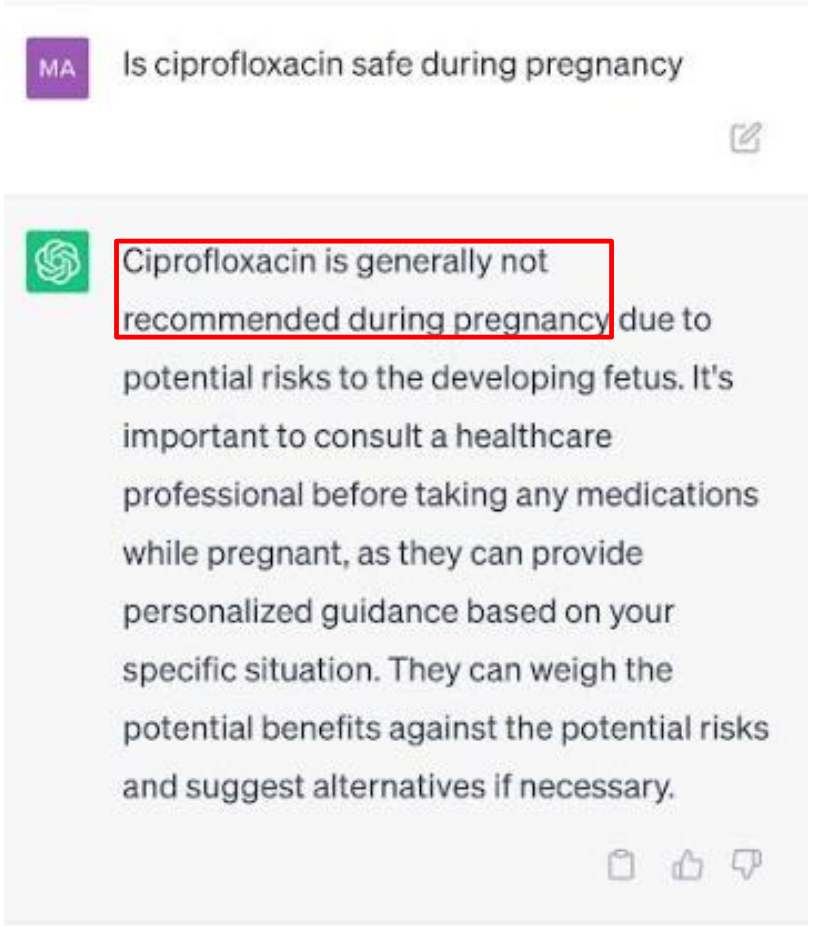
Are we going to lose our jobs????

Ciprofloxacin safety in pregnancy

June 8th 2023



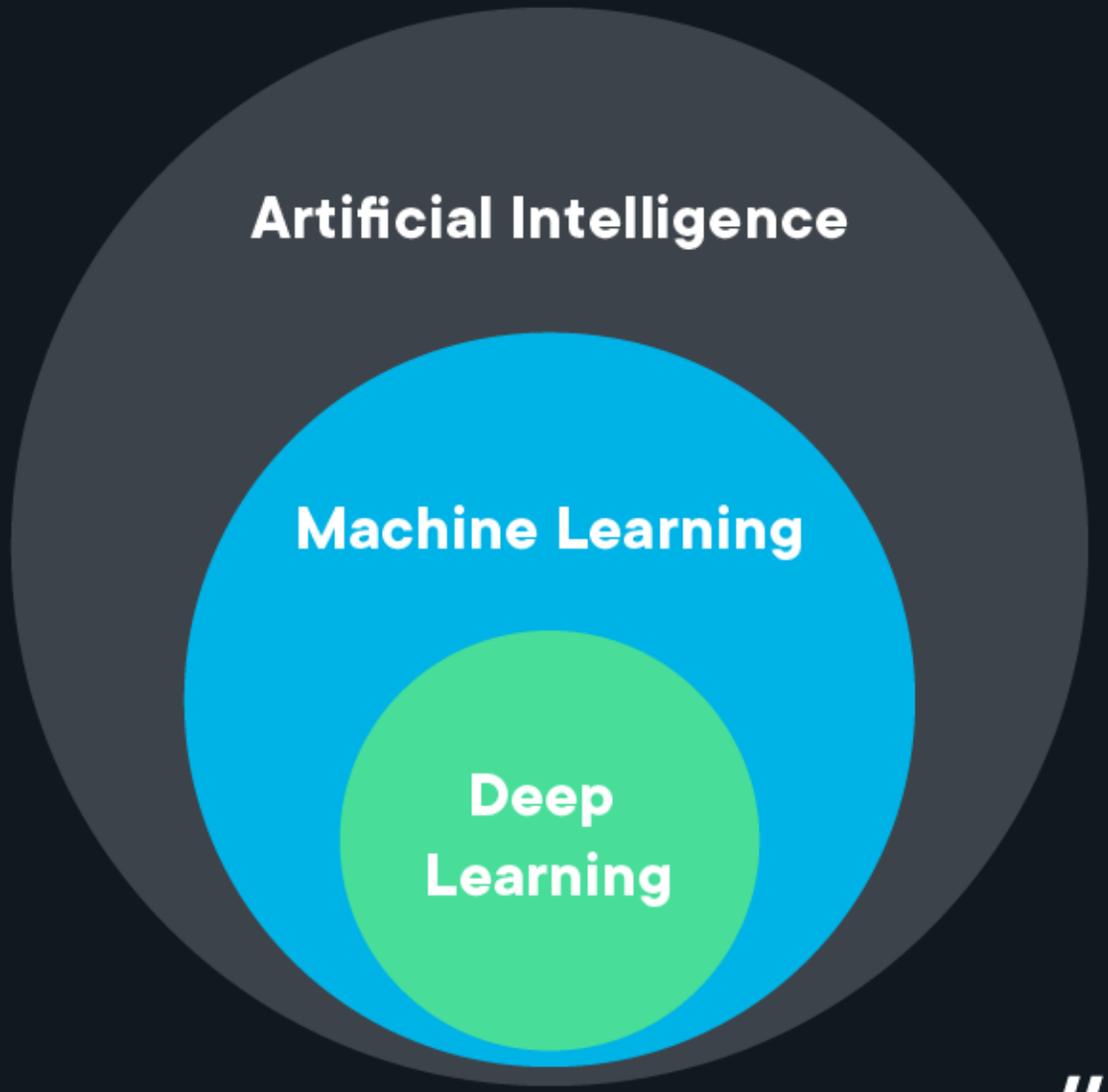
August 14th 2023



Artificial Intelligence
A science devoted to making machines think and act like humans.

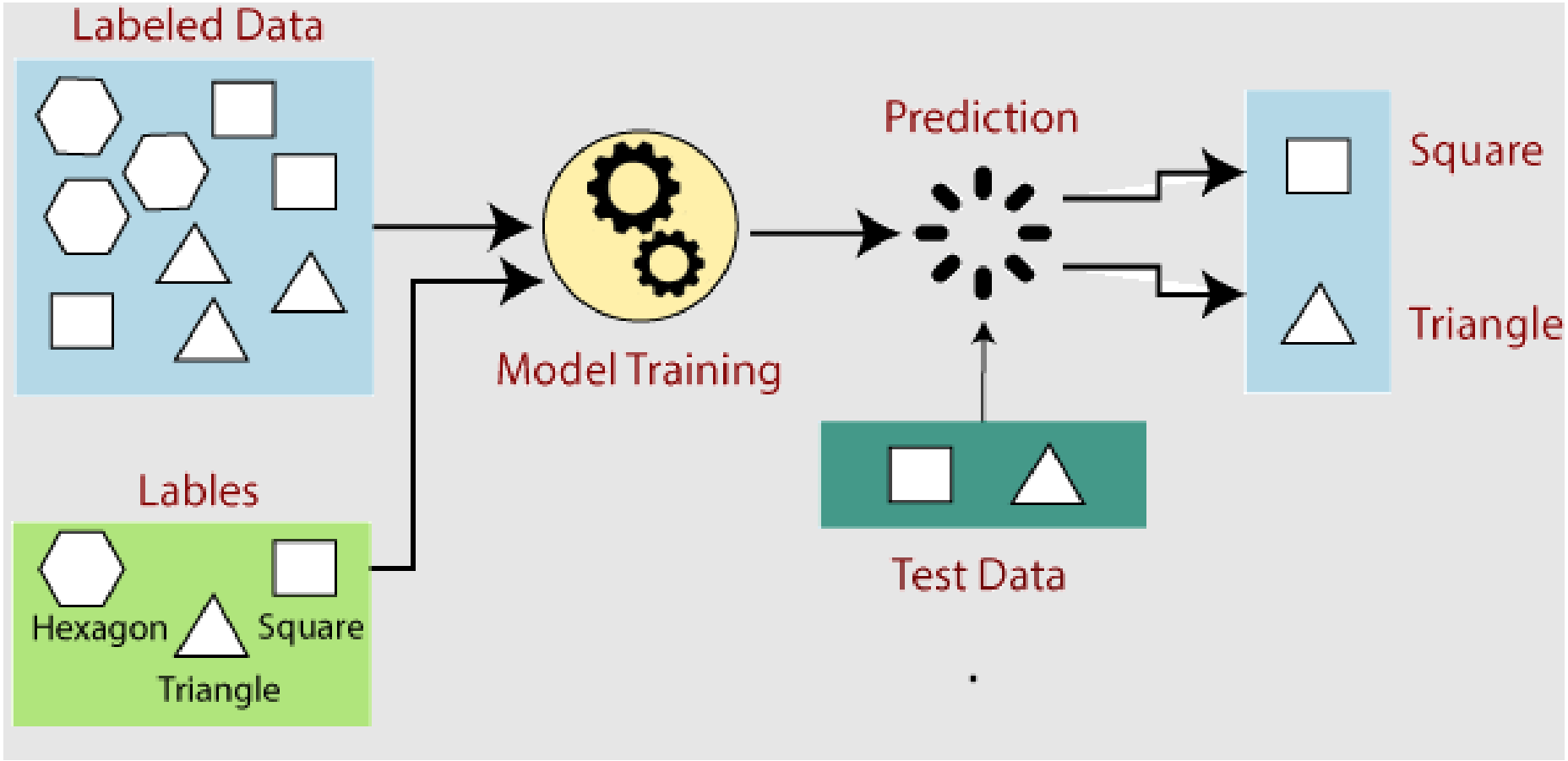
Machine Learning
Focuses on enabling computers to perform tasks without explicit programming.

Deep Learning
A subset of machine learning based on artificial neural networks.



https://flatironschool.com; accessed June 2023

How Machine Learning Works?



https://www.javatpoint.com/how-does-machine-learning-work

If you can't beat them, join them!

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Original Paper

Data and text mining

Explainable multimodal machine learning model for classifying pregnancy drug safety

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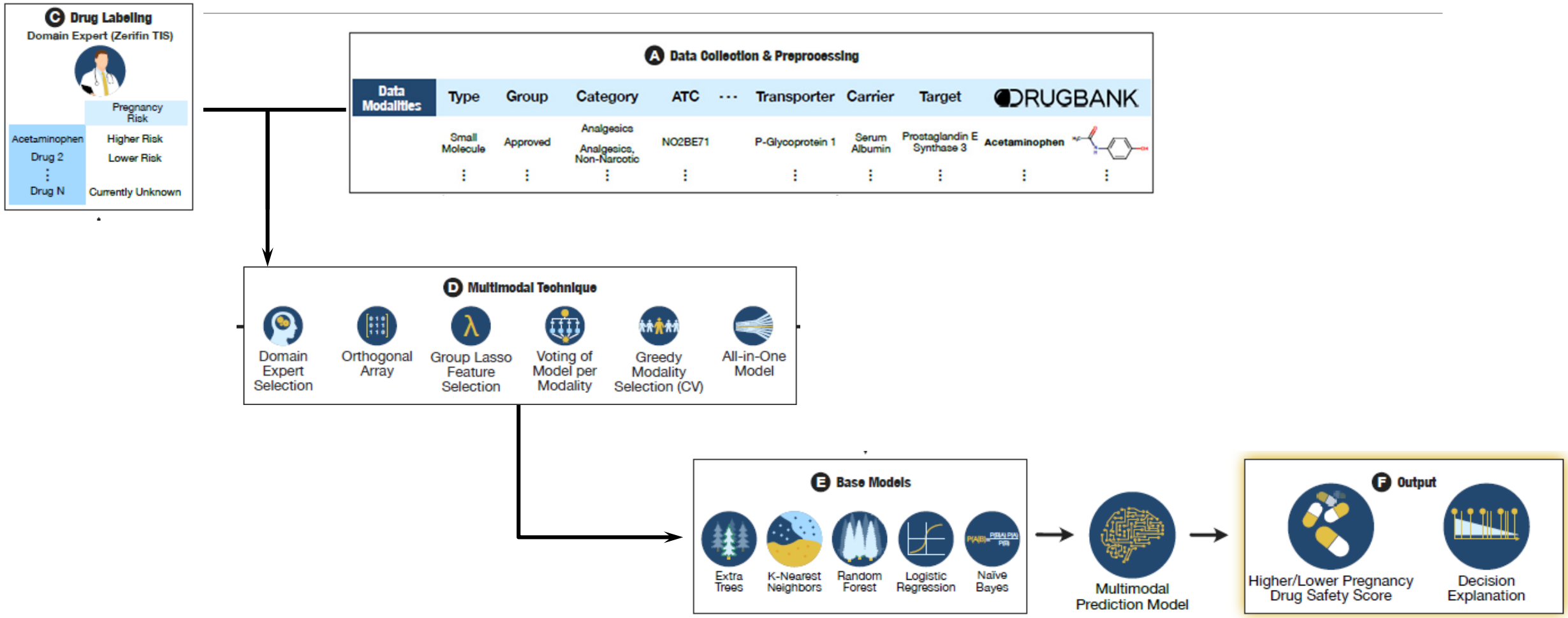
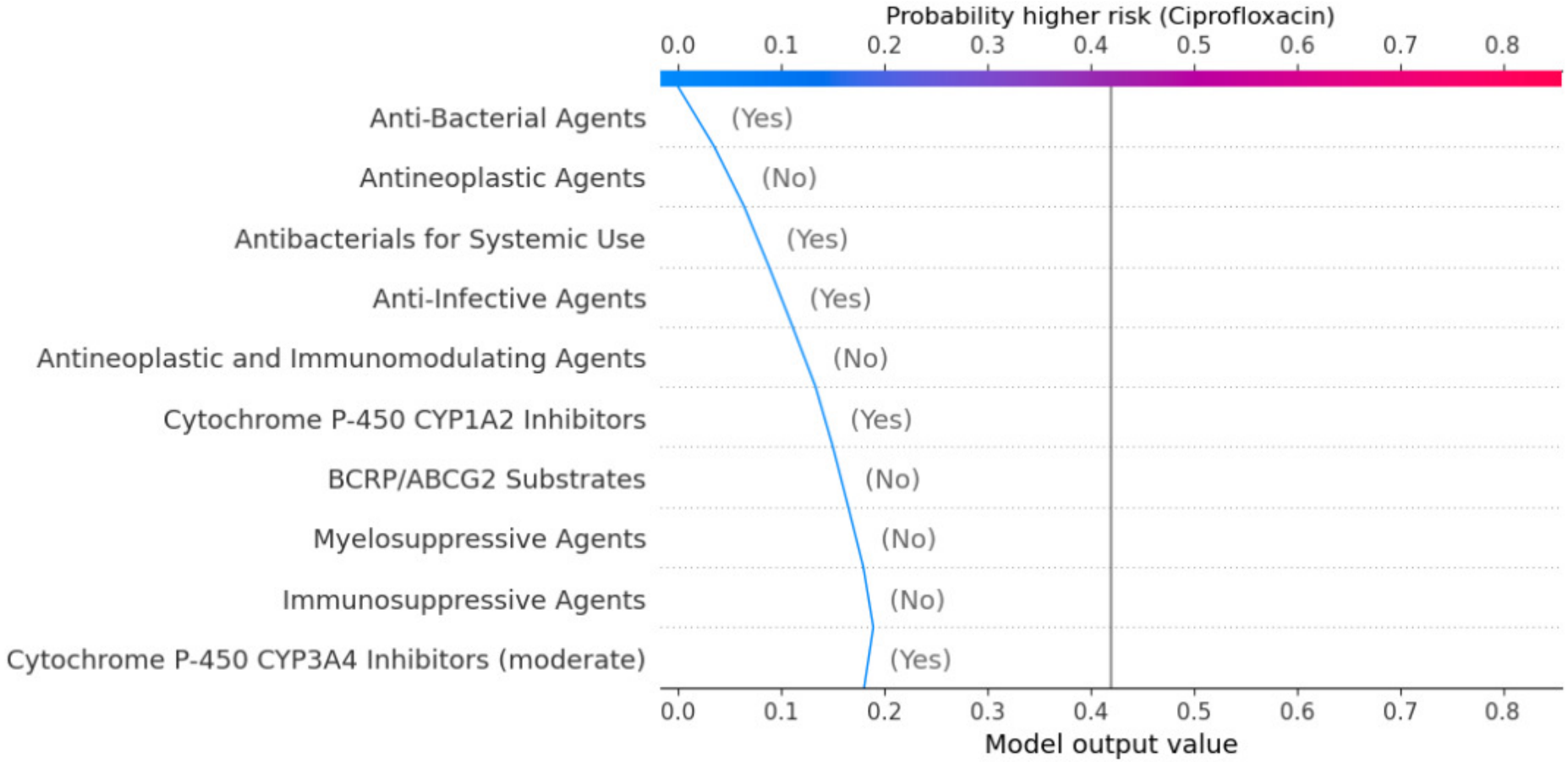
The model development



Algorithm decision plot – Ciprofloxacine



Predicting drug safety during breastfeeding using machine learning

Supervised machine learning: Training phase – breastfeeding

Incompatible drugs

Compatible drugs

Pregnancy data from previous study

RDKit

Open-Source Cheminformatics and Machine Learning

DRUGBANK

Output

High/low Lactation safety score

Decision Explanation

Evaluation – How can we tell our model is accurate?

No. of drugs used:

Cross validation

270

- Hide some drugs, check if model classified correctly. Repeat and average result

Independent expert

30

- Ask another, independent expert to classify drugs. Check if second expert and model agree

Separate Pregnancy and Lactation Safety Drugs

14

- Drugs where lactation and pregnancy safety are not the same. Check if model correct

Medications with **teratogenic risk**, but **compatible** with breastfeeding

- Warfarin
- Carbamazepine
- NSAID's – poses risk after 20 weeks of pregnancy
- Enalapril - Contraindicated after 12-13 weeks of pregnancy
- Doxycycline - Contraindicated from 14 weeks of pregnancy
- Misoprostol (Cytotec)

Medications **safe** during pregnancy, but **incompatible** with breastfeeding

- Lithium
- Codeine
- Sotalol
- Pseudoephedrine (reduced milk production)
- Cabergoline (reduced milk production)

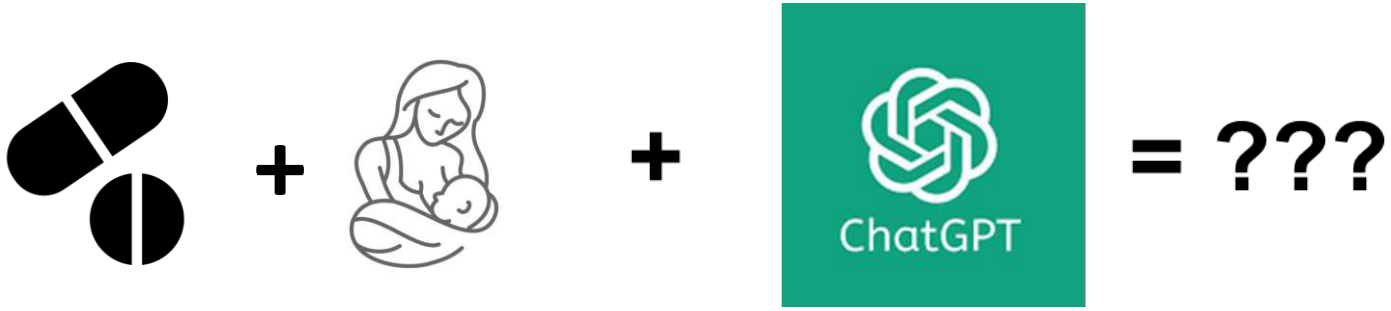
Results

	ROC cross validation	ROC second expert	ROC pregnancy CI
Categories + pregnancy data	**0.921**	0.961	0.904
Categories only	0.803	0.958	**0.908**
Pregnancy only	0.917	**0.99**	0.842
Categories + chemical data	0.812	0.953	0.904

***ROC = area under the Receiver Operating Characteristic curve**

Performance of the model: The Higher – The Better

Liraglutide (Saxenda, Victoza)



Liraglutide safety during breastfeeding

Limited information is available regarding the use of liraglutide during breastfeeding. Liraglutide is a medication used to treat type 2 diabetes and obesity.

Liraglutide is a relatively new medication, and there haven't been extensive studies conducted specifically on its safety during breastfeeding. As a result, it's challenging to determine its exact effects on breastfed infants.

Liraglutide is a large molecule that is not expected to pass into breast milk in significant amounts. Additionally, it undergoes degradation in the gastrointestinal tract, further reducing the potential for absorption by the infant.

While there is no known evidence of harm associated with liraglutide use during breastfeeding, it is still recommended to exercise caution. It is advisable to consult with a healthcare professional, such as a doctor or pharmacist, who can evaluate your specific situation and provide personalized guidance.

Consider discussing alternative treatment options o temporarily discontinuing liraglutide while breastfeeding, depending on your individual needs and the availability of suitable alternatives. This decision should be made in consultation with your healthcare provider, taking into account the potential benefits and risks to both the mother and the infant.

June 8th 2023

As of my last update in September 2021, there may not be enough comprehensive data available to determine the safety of using liraglutide during breastfeeding. It's important to consult a healthcare professional who can provide you with the most current and accurate information regarding the safety of specific medications while breastfeeding. They can assess your individual situation and provide guidance based on the latest research and medical knowledge.

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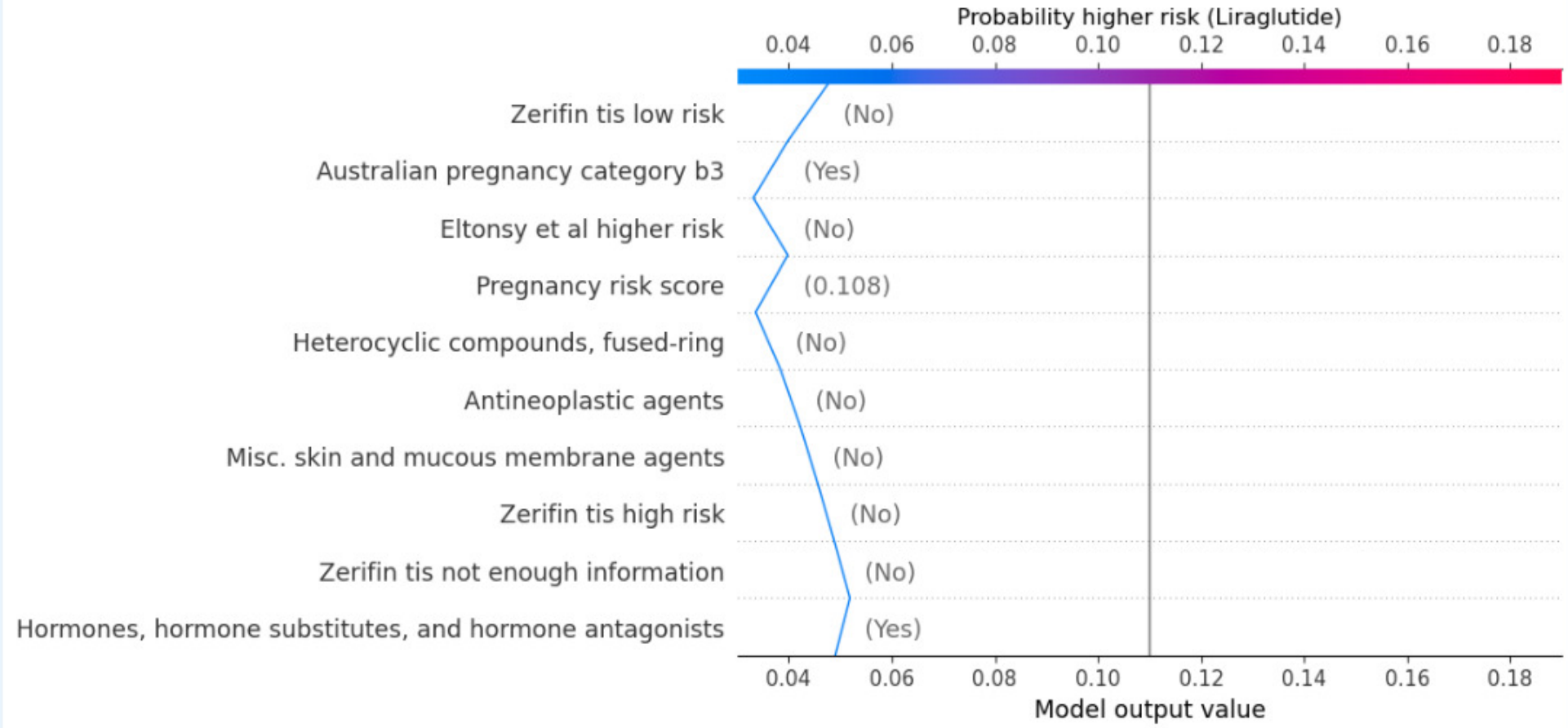
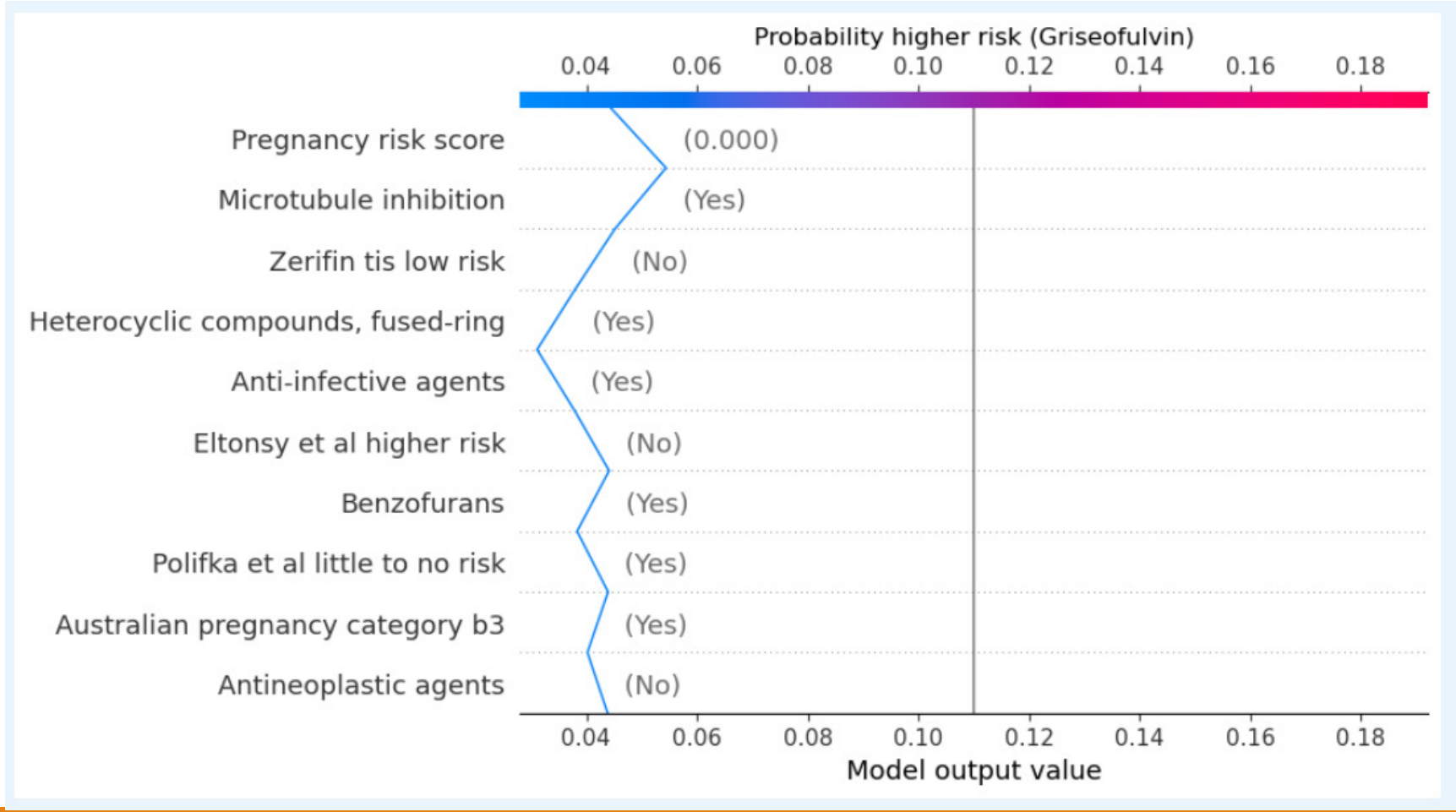
Liraglutide (Saxenda, Victoza)

Decision plot



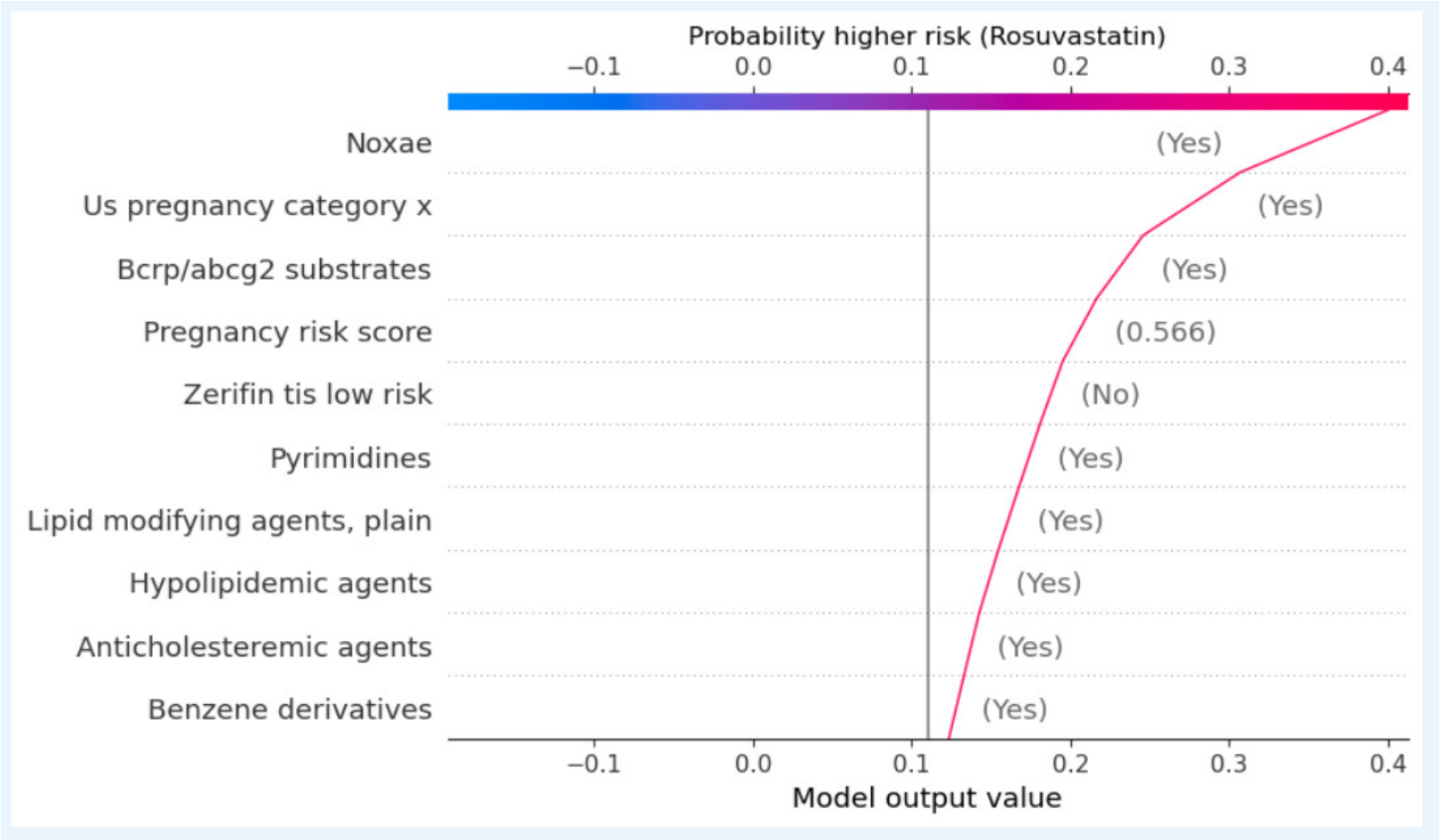
Griseofulvin (No data available)

Decision plot



Rosuvastatin (“Crestor”)

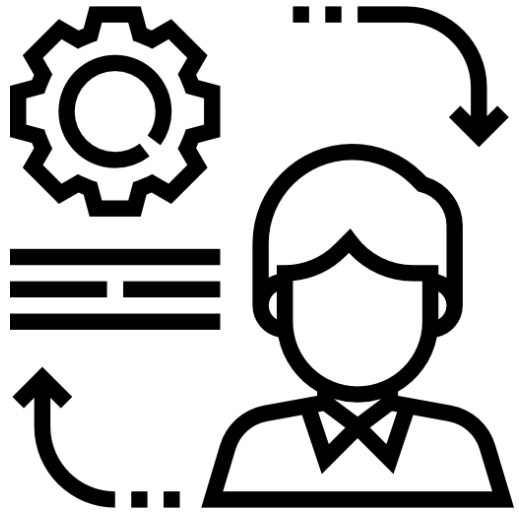
Decision plot



Medication use in breastfeeding – AI recourses

- DR GOOGLE – NO
- ChatGPT – NO
- Machine learning algorithms – probably yes

EXPERT OPINION – still needed !!!



Thank You!