



2021
embedded
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VIRTUAL | MAY 25-28

Maintaining DNN Accuracy When the Real World is Changing

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Observe – observanow.com



Object Detection Using Deep Learning NNs



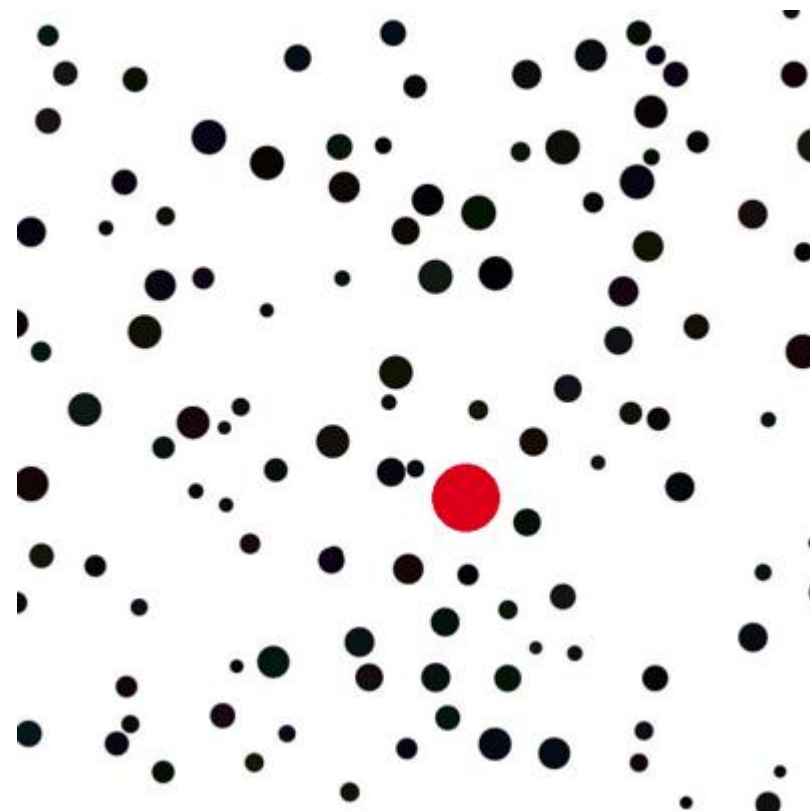
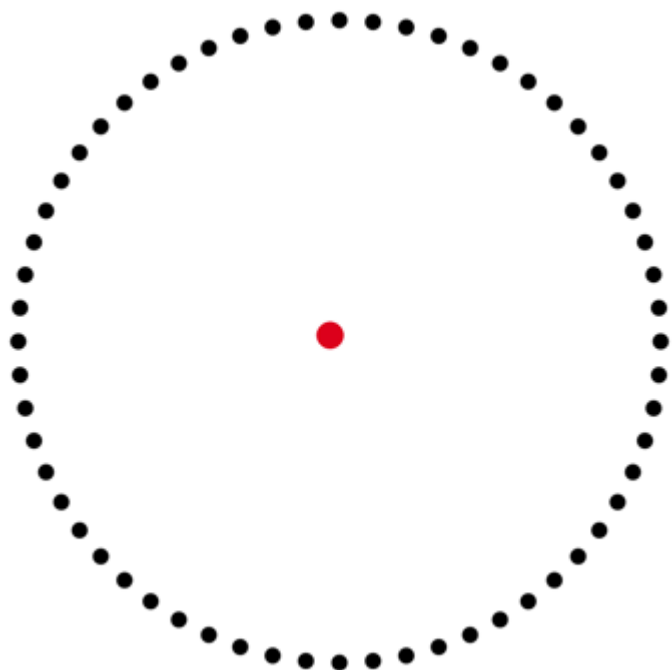
Defining Dataset Drift



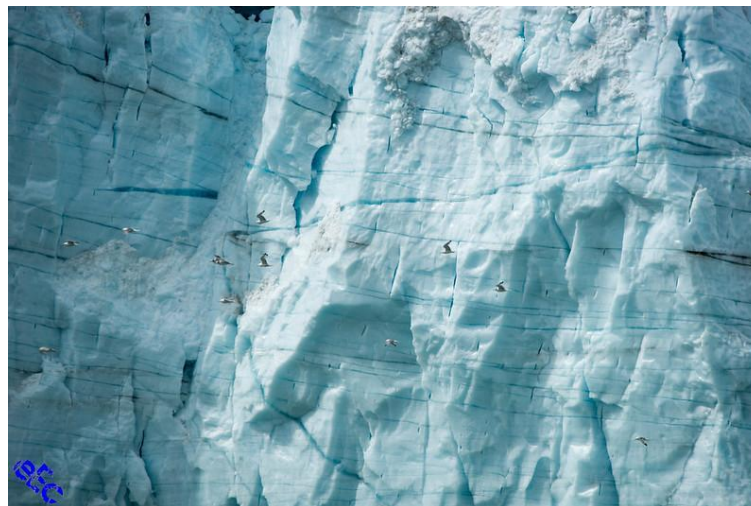


Let's Talk About Variance

Variance in a Dataset



Variance in Images – Easy for Humans



Environmental Variance



Planned/Expected Variance



Adding Variance



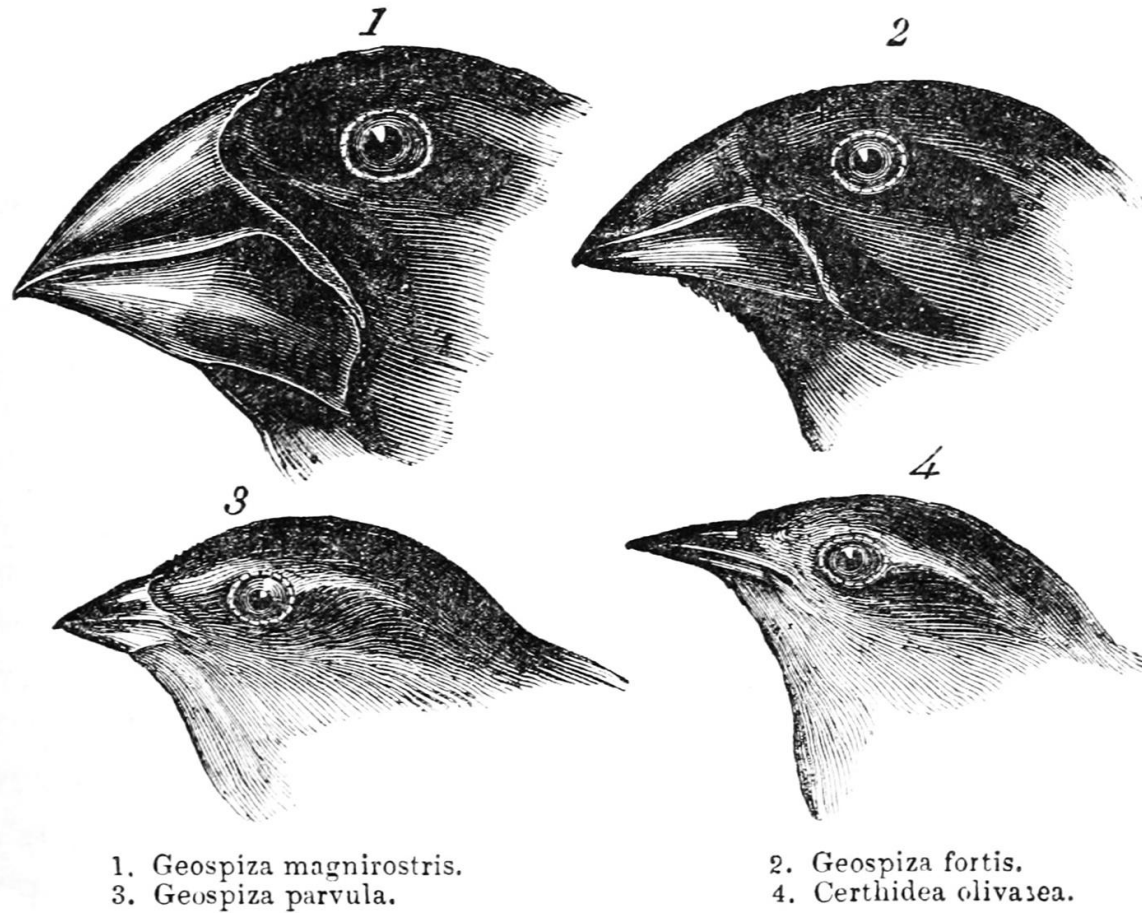


Drift – Time Introduces Real World Variance

Unplanned Variance (A Rose is a Rose is a Rose...)



Evolutionary Variance: Diversity (Phylogeny)



Evolutionary Variance: Extinction





Handling Variance

- Declining confidence
- Frequency: No longer detecting objects at the same rate
- Human review
- You're told about them
- OCR
- Pixel methods

Practical



Difficult

- **Using a taxonomy that leads to an unknown endpoint**
 - Bottle → BrandX → FlavorY → New Size?
- **Generalized object detection results compared to specialized models**
- **Assuming large pixel gaps between detected objects are new classes**
- **External context, e.g., sales data with no identified classes**

Practical



Difficult

When is it Time to Forget a Class?

- “Forgetting” a class to have the model(s) no longer detect it as an object
- Considerations
 - How much does it cost to retrain a model from scratch?
 - How many classes per model?
 - Are the forgotten classes now negative examples? E.g., Is the forgotten class something that is easily confused with the positive examples and makes good training data?
 - Cost of running object detection
 - Cost of maintenance (review, labeling, golden set)

When is it Time to Retrain?

- Considerations
 - Cost to retrain model(s)
 - Cost to deploy models to all users
 - Size of changes to the dataset
 - Cost of getting something wrong
 - Cost of detecting things not cared about
 - Starting over or resuming from a pre-trained model



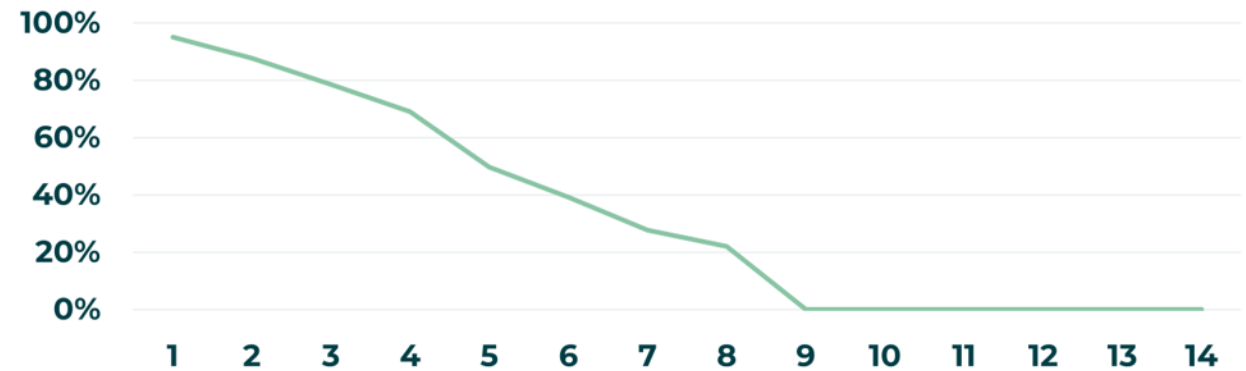
Case Studies

Case Study: Taco Shells

Major Package Changes

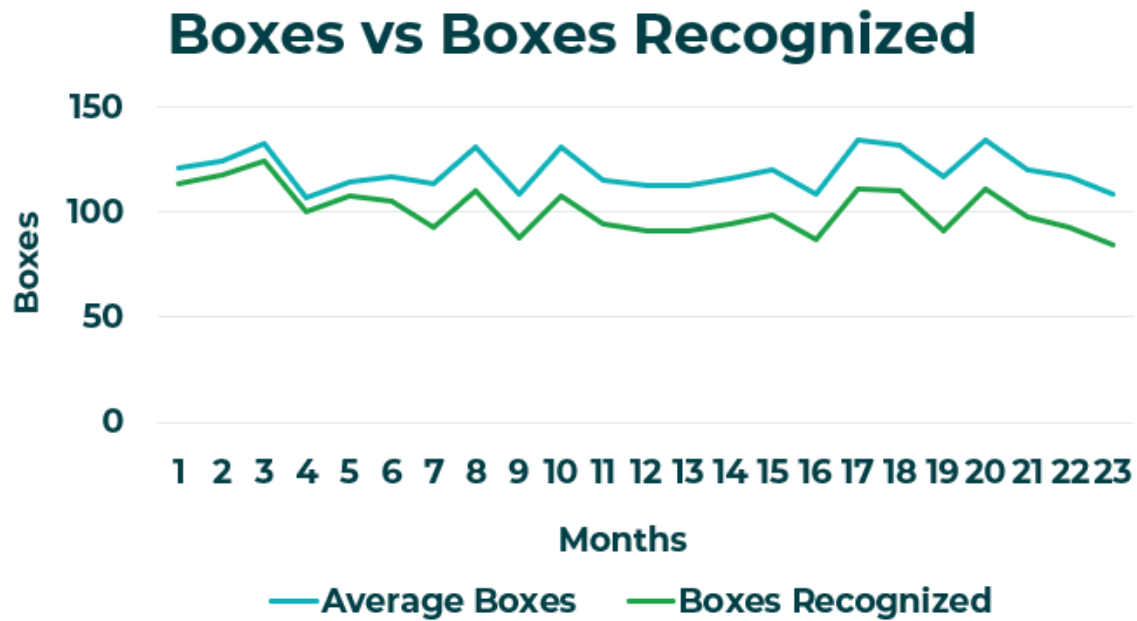


Percent of Stores With Yellow Corn Taco Shells In Stock by Month



Case Study: Taco Shells

New Entrants



Case Study: Natural Food Products

Subtle Package Changes



Average Confidence of 5 Grain Cereal Model





In Conclusion

In Conclusion

- Be an expert in your dataset
- NNs are expensive to maintain
- Know impact of your results
- Get context data if you can
- Have a method for review
- Maintain your training/deployment methods
- Find inspiration in other disciplines

AI Overview for CPG and Retail

observa.link/ai-overview

Inferring the Historical Patterns of Biological Evolution

econgeography.org/faculty/pbergmann/biostats/Pagel%201999.pdf

To Remember, the Brain Must Actively Forget

quantamagazine.org/to-remember-the-brain-must-actively-forget-20180724/