Machine Learning in MVPD Video Advertising

Mile High Video Workshop – Denver, 2019

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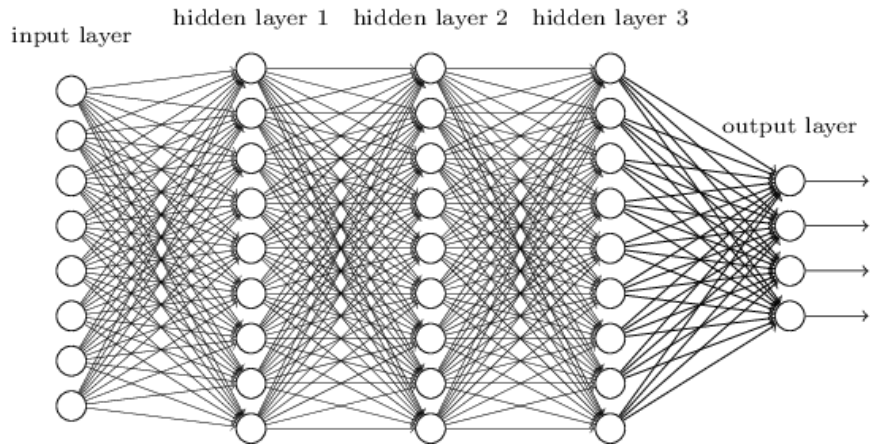
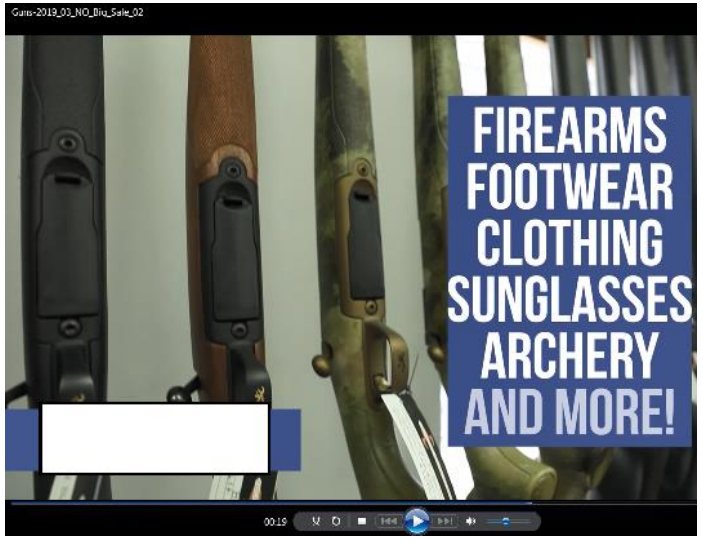


ML For Carrier-Class Video Analysis – Sample Use Cases

- **Ad Ingest QC (Quality Control)**
- Ad Classification
- Contextual Advertising
- Ad Recommender
- Thematic advertising
- Personalized Ads/Content

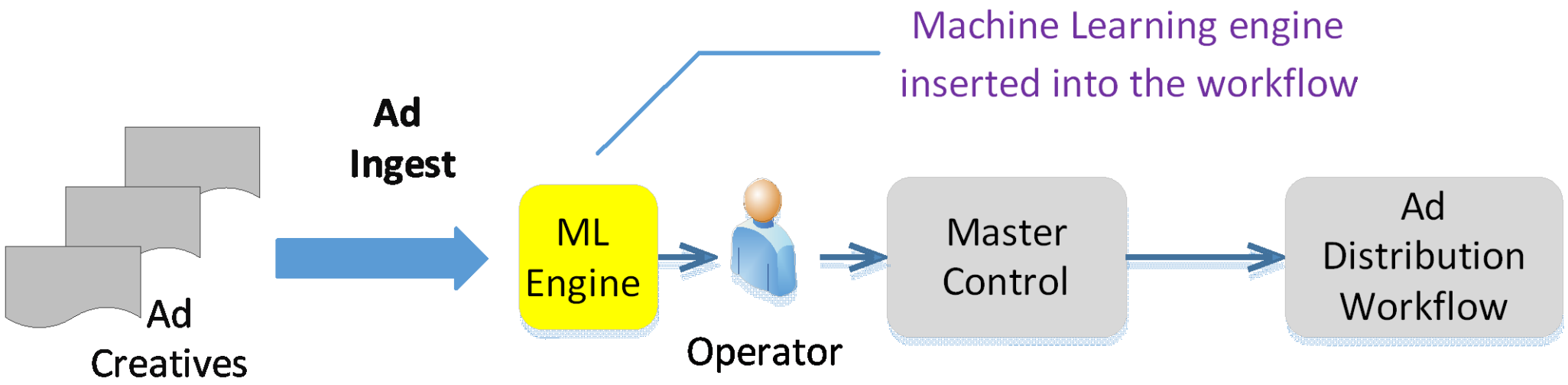
Ad Categories with Restrictions
Alcohol
Tobacco
Drugs
Gambling, Casino
Copyrighted content
Trademarked content
Explicit Content
Profanity
Sexual products
Violence
Competitor content
Political Content

Restricted/Non-Compliant TV Ads – Sample Video Clips



Ad Ingest Quality Control - Workflow

Identifying non-compliant/restricted content



Non-Compliancy of Ads

a) Regulatory Compliance

- *"Broadcasters are responsible for selecting the broadcast material that airs,…including advertisements." (FCC)*.
- Federal agency regulations applicable to ads (FCC, FTC, FEC, FDA etc.)

Examples:

- Ads related to alcohol, tobacco, firearms, gambling etc. subjected to federal guidelines.
- A political ad is required to display a statement from the sponsor for at least 4 seconds.
- Truth-in-advertising – An ad may be deemed deceptive for misleading/missing information.

Non-Compliancy of Ads II

b) Contractual Compliance

- Contractual constraints are imposed by content providers (e.g. ESPN)

  e.g. Restriction on alcohol ads during ESPN Little League World Series.

c) Business/Operational Compliance

- Operational guidelines and best practices established by the enterprise.

  e.g. ‘frequency capping’ or limiting the display of the same Ad.

Links to References*

[1] FCC Guidelines for Ads - https://www.fcc.gov/consumers/guides/complaints-about-broadcast-advertising

[2] FTC Guidelines for Ads - https://www.ftc.gov/tips-advice/business-center/guidance/ftcs-endorsement-guides-what-people-are-asking

[3] FDA Guidelines for Ads - https://www.fda.gov/media/82590/download

[4] FEC Guidelines for Ads - *https://www.fec.gov/help-candidates-and-committees/making-disbursements/advertising/*

[5] ESPN Advertising Guidelines - http://www.espn.com/adspecs/guidelines/en/ESPN_AdStandardsGuidelines.pdf

(**not an exhaustive list)*

Machine Learning for Video Analysis – Tool Capabilities

Video/Image

- Faces, people, animals and objects
- Emotions (smiling/frowning)
- Celebrities database
- Activities (limited)

Audio

- Derive audio transcripts
- Sentiment (positive or negative)

Text

- OCR analysis from textual content

Machine Learning Based Video Analysis – Applications

- **Sports Applications –** Soccer (bounding box)
- **Surveillance –** Identify a person/face or common objects
- **Mobile Apps –** Curated playlists, image/video analysis

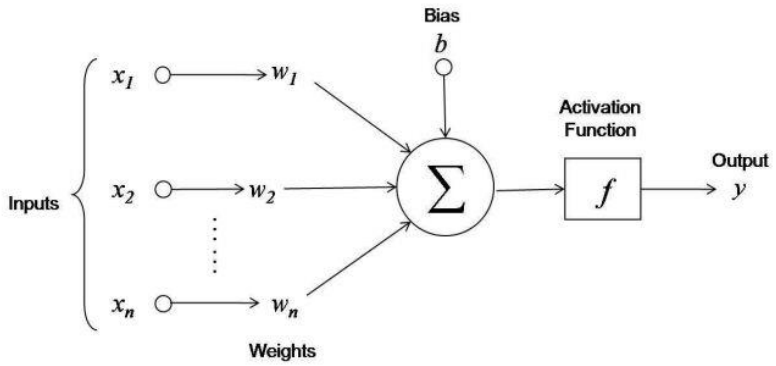
Photo Credit: Pexels.Com

Machine Learning Challenges in Video Analysis

- Labels that are too generic may not capture the essence of the video. Need to be more descriptive.
- Activity identification is a challenge
- Prediction speed low

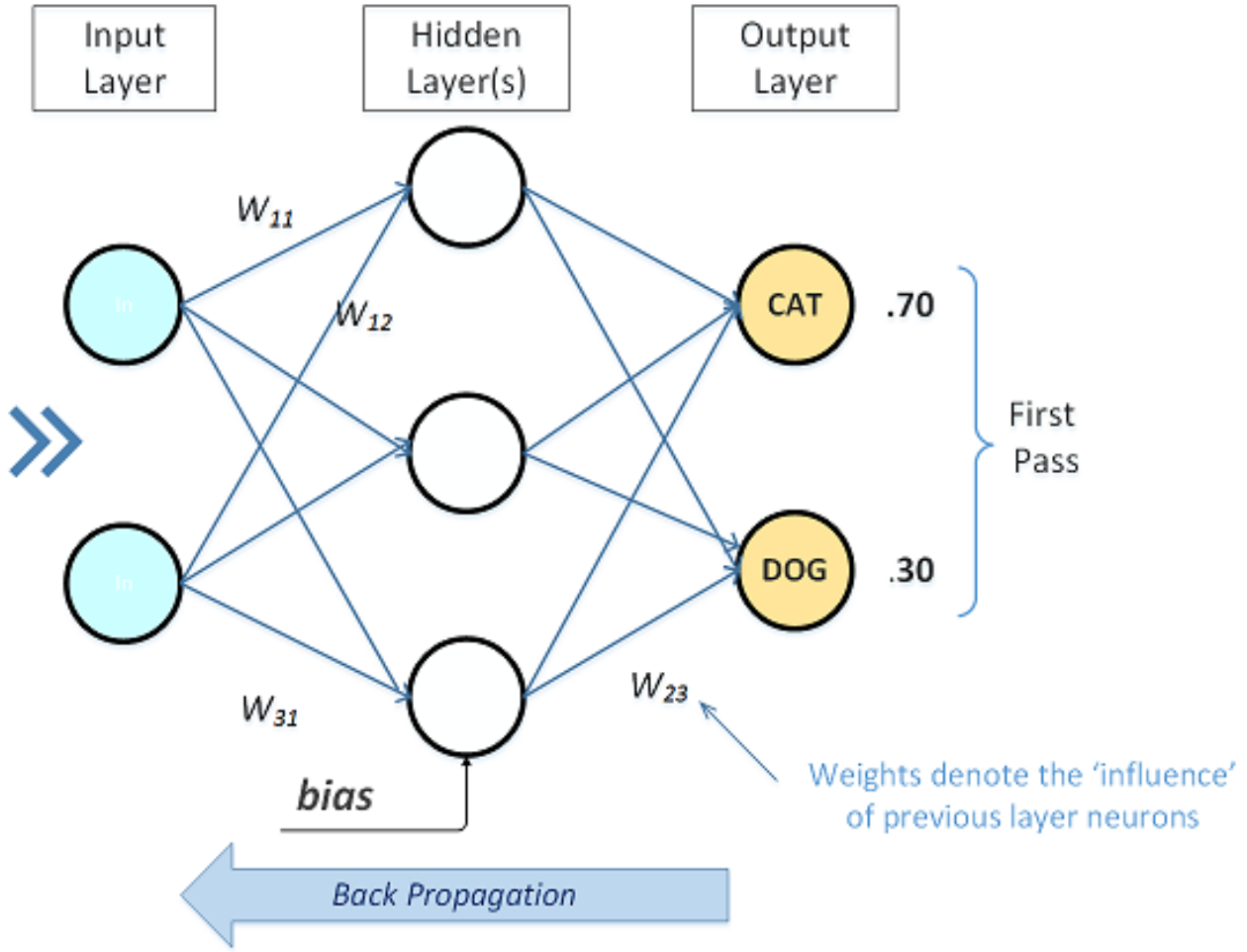
Dominant Activity	Suggested Ads
Cooking	Utensils, Cooking classes, Kitchen appliances
Car chase	Car ads/repairs, auto insurance
Shopping	Retail store ads
Eating	food ads, restaurant
Dancing	Clothing , Personal care, Alcohol ads
Drinking	Alcohol ads
Social gathering	multiple products
Kids playing	toys, food and drink ads, medicines, clothing
Sports activities	sports related products
Anxiety, Arguing	pain medications, lawyer ads

Artificial Neural Network – How It Works



Neuron Functionality

Photo Credit: Wikimedia.org



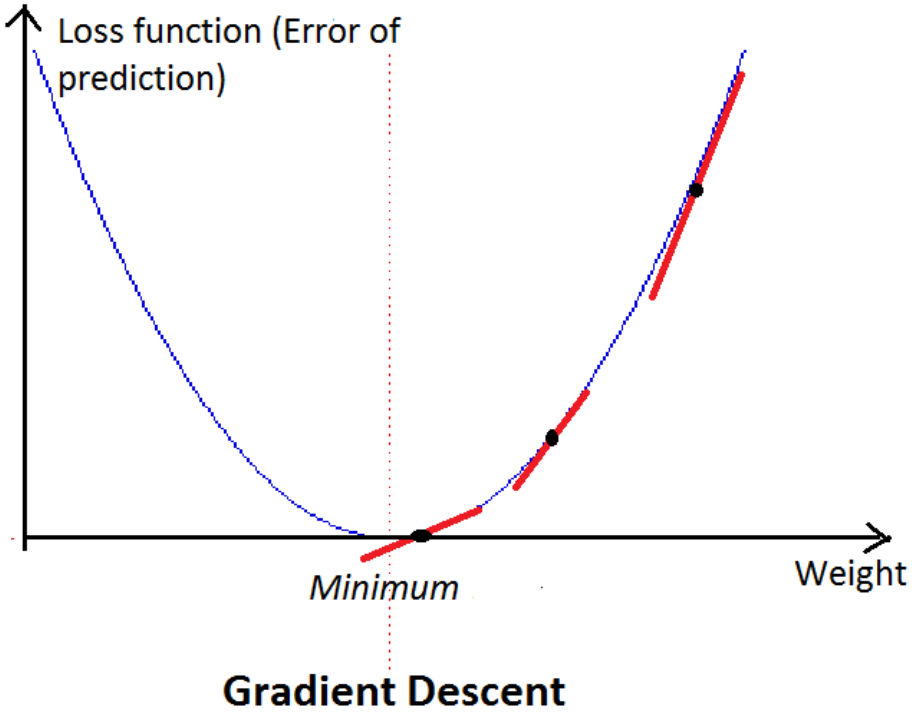
Artificial Neural Networks – Training Method

Minimize Prediction Error

Loss (or Cost) Function = C

C = Actual value – Predicted Value

C_{min} occurs when $\partial C/\partial w \rightarrow 0$



Deep Learning Models for Image and Video Classification

- Issues with general artificial neural networks (ANN) models
    - Training time and accuracy
    - Training neural networks – Transfer learning paradigm

- Convolutional neural networks (CNN) – Good for Image classification
- Recurrent neural networks (RNN)
    - For time-series analysis/video (Memory based)
- RNN suffers from vanishing gradient/Exploding problems.
- Long Short Term Memory (LSTM) algorithm is a solution (‘forget gate’)

Test Results – ML Video Analysis Example

Video Clip – Farm Bill

Content Descriptors Identified By Machine Learning Tool

- Dairy farmers
- Legislation
- Agriculture subsidies
- Food Stamps
- Poverty
- Tractors
- Subsidy reform
- Wild fires
- Environmentalists
- Hemp Industry
- THC
- Indoor
- Screen
- Woman
- Monitor
- Sky
- Smoke
- Plane
- Mountain

Test Results – False Positives

In this example, the tool misidentifies the bright light in the dark background as ‘fireworks’ (with a high ‘confidence level’).

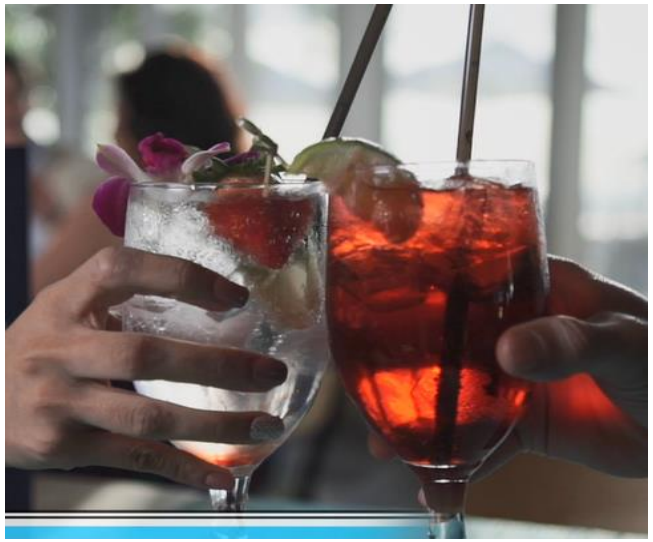
False Positive – Fireworks

Machine Learning Detection and Error Mitigation

Detected Category	Initial Confidence Level	New Confidence Level
Fireworks has been detected from 00:00:02 to 00:00:03	90%	< 30%

Test Results – False Negatives

In this example, the tool failed to identify the alcoholic beverages during Image Analysis.



False Negative - Alcoholic Beverage

However the term ‘Cocktails’ is noted in the audio transcript


```
{
        "id": 4,
        "text": "You can enjoy our hot tub cocktails and R Florida.",
        "confidence": 0.9069,
        "language": "en-US",
        "instances": [
         {
          "Start": "0:00:16.74",
          "End": "0:00:19.82",
         }
        ]
}
```

Conclusions

- Off-the-shelf products are more oriented towards facial recognition.
- Useful in sports and surveillance; however MVPD applications have more stringent requirements.
- Multi-stream heuristics based method is proposed to complement the current approach.