

**3rd International Conference on Emerging Technologies in Data Mining and
Information Security.**

ANALYSIS OF USER INCLINATION IN
MOVIE POSTERS BASED ON COLOR
BIAS

Paper ID: 234

AGENDA

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INTRODUCTION

WHAT ?

Objective of our research was the analysis of the effect of visual bias on user's choice. Starting with collecting user ratings across predefined movie genres, applying style transformation based on the resultant genre on a random set of posters, and obtaining the new set of ratings from the user.

HOW ?

By implementing the style transformation deep learning algorithm to detect and analyse visual bias by calculating the difference in the cross-genre rating before and after the image transformation



PROBLEM STATEMENT

- ❑ **Visual bias** - the phenomenon of showing a preference/prejudice for a particular visual stimulant. Like every other cognitive bias, visual bias affects the decision making to a great extent.
- ❑ **More content than ever** - Due to the widespread and rapid growth of OTT platforms such as Netflix, Amazon Prime, and more. Applications are looking for avenues to customize user experience. Visual bias is a dominant feature for the same. To create a customized user experience, visual bias can be used to tailor movie posters to their liking, including elements that they are biased towards. The implications of altering these elements of visual bias can be interesting.

We aim to delve into this concept to get evidence of this bias and how strongly it affects user decisions.

- ❑ **Objectives:**
 - To create a web interface for collecting user ratings across different movie genres
 - Identify the genre the user is biased towards
 - Detect and analyse the visual bias using style transformation deep learning algorithm, more specifically image transformation using neural style transfer
- ❑ The **conclusion** of this study can be extremely helpful for the show business and can be extrapolated to various other industries such as the OTT platforms, AdSense and more. With customized recommendations for users, it is guaranteed to lead to prolonged user engagement and satisfaction.

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LITERATURE SURVEY

- Visual bias can thus be described as the phenomenon of showing a preference for a particular visual stimulant based on some inherently unique characteristics.
- Recently, the field of visual bias study has garnered much interest due to the tremendous untapped potential it has of increasing revenues for online business and streaming platforms, etc. An example of one such endeavor is the "Outsmarting the Human Mind" project by Harvard University.
- In terms of the consumer space, the most obvious example of visual bias exploitation is the OTT platform Netflix's ever-changing thumbnails. Based upon the kind of genre and actor preferences that a user's movie selection may display, the company switches around pre-made thumbnails to maximize user engagement.
- A recommendation system may be defined as a machine learning technique that is used most predominantly in the online consumer space to suggest to the users items that would best suit their needs based on results of past behavior and activities.
- Neural Style Transfer technique which is a convolution neural network application that helps to transfer the aesthetic styles of one image onto another one. This has been done in order to overcome the inherent multi-poster production costs that rudimentary visual bias incorporations may bring about.

KEY COMPONENTS OF THE PROJECT



CREATING DATABASE

Obtaining foreign movie titles from IMDb



SEGREGATING

Using genres to segregate posters



APPLYING STYLE TRANSFER

CNN algorithm to apply style transfer based on bias-genre combinations



GAUGING BIASES

Using posters to determine user bias



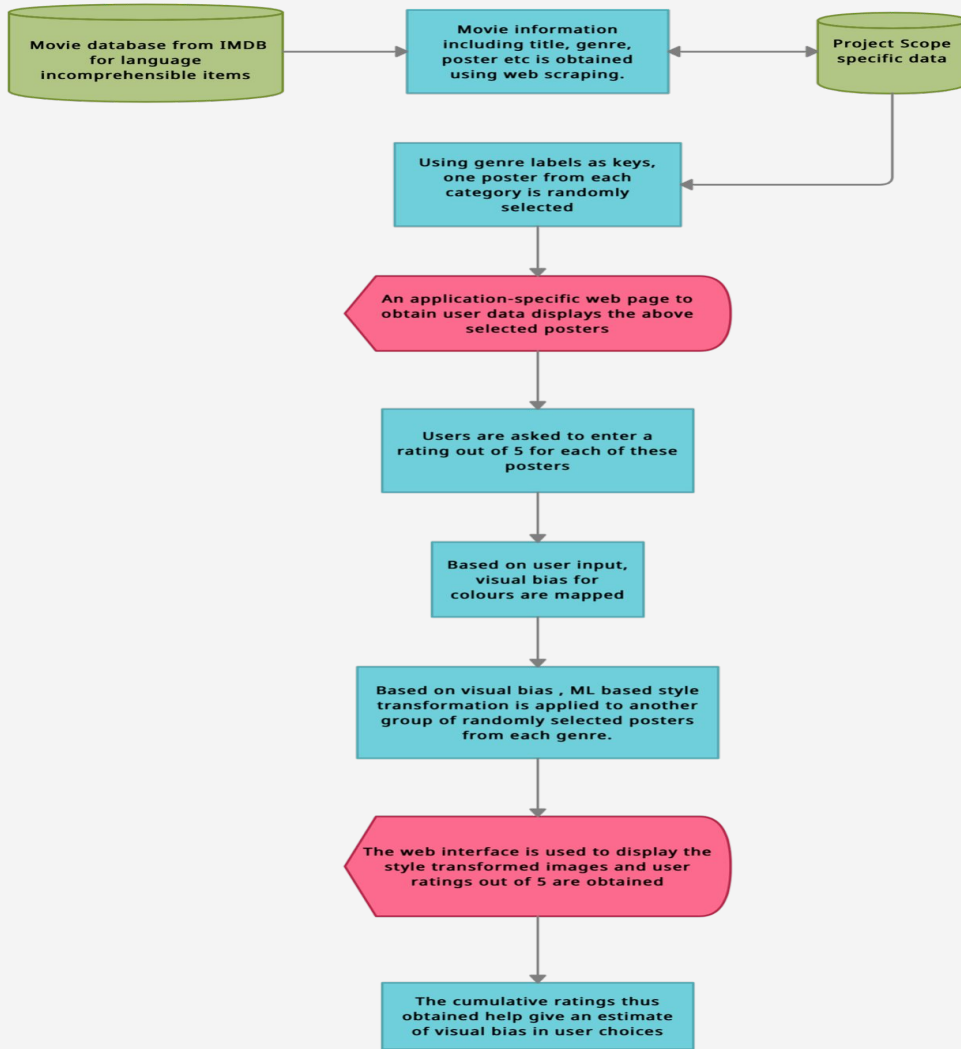
PRESENT TRANSFORMED POSTERS

Use bias value to display suitable posters



SCORING AND FINAL CALCULATION

Calculating final biases as empirical evidence for analysis.



TECHNOLOGY STACK

01

HTML, CSS, Flask

Survey Website for collecting information

02

Python

Exploratory Data Analysis

03

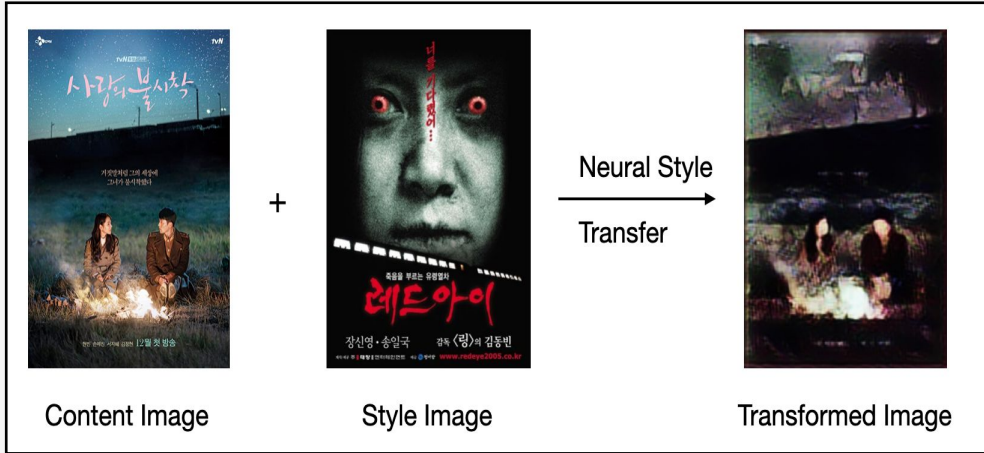
Python and Tensorflow

Style Transformation

04

**Visualization libraries :
pandas, matplotlib**

Modelling Approach and
Analysis of Results



Bias	Horror	Comedy	Romance	Thriller	Action
Horror	✗	✓	✓	✓	✓
Comedy	✓	✗	✓	✓	✓
Romance	✓	✓	✗	✓	✓
Thriller	✓	✓	✓	✗	✓
Action	✓	✓	✓	✓	✗

Analysis of User Inclination in Movie Posters Based on Color bias

Minor Project

Welcome!

The visual bias detection project is designed to decisively detect and quantify the existence of visual bias in users while making movie and product selection decisions. To do this we make use of the **style transfer machine learning algorithm** and select custom mathematical models.

This online portal has been created to urge our peers to participate in our experiment and help us collect relevant data.

Interested in contributing? Take our quiz by clicking the link below.

Take Quiz



Analysis of User Inclination in Movie Posters Based on Color bias

Minor Project

Rules

1. You will be first presented with 5 movie posters and asked to rank those. For instance, you should place the movie you are most likely to watch on number one, followed by the next most likely one and so on.
2. Once you are done entering the rankings, click on submit.
3. Your results will be computed. This process may take a while. You are requested to stay on the page. Do not go back or try to refresh.
4. Once your results are computed, you will be presented with 5 more posters and asked to rate these on a scale of 1-5.
5. Once you are done, press submit. If everything goes well, you will be redirected to the submission confirmation page.

Start

Analysis of User Inclination in Movie Posters Based on Color bias

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Data Collection

The data entered will only be used to assess the results for this study. We would not use it for any other purposes.

Name

Enter DISTINCT ranks (1-5) for the images



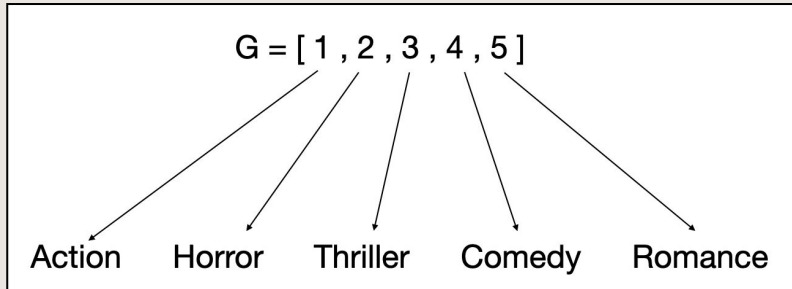
Enter rank for image 1:

Activate W
Go to Settings

MATHEMATICAL RESULT AGGREGATION

$$X = (x_2^{(i)} - x_1^{(i)}), i \in G \quad \dots(1)$$

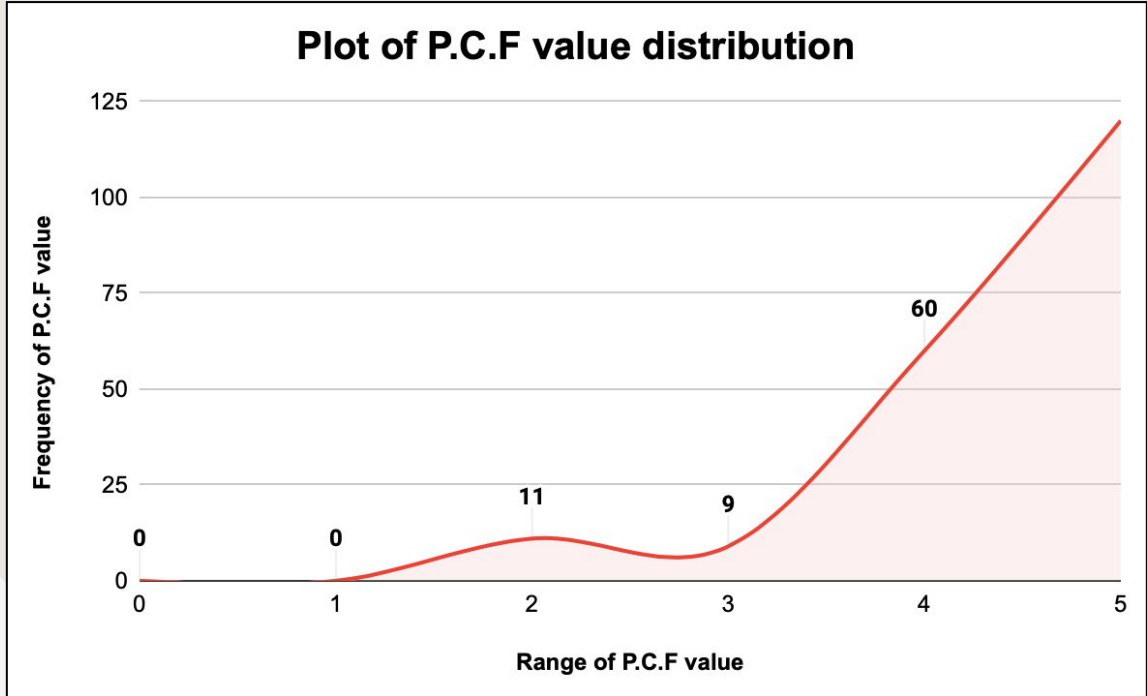
$$P.C.F = \frac{\sum_{i=1}^5 (x^{(i)} - \bar{x})}{5} \quad \dots(2)$$



In equation (1), $x_2(i)$ represents the stage 2 rating for the style transformed image and $x_1(i)$ represents the stage 1 rating for the original image. In both these cases, i represents the genre under consideration and can have one of the five values contained in set G indicated by figure 3 at any instance of time. X in equation (1) is a 1×5 dimensional matrix that holds the correlation difference amongst the corresponding genres in stage 1 and 2 images. In equation (2) P.C.F represents the positive correlation factor and is calculated by estimating the mean deviation of the values contained in matrix X . For each of the users, the P.C.F value is estimated and lies on a scale of 1-5. The value of this factor is used as an indicator of the empirical magnitude of visual bias detected in the user and the results of this for the study are discussed in the next section.

Intuitively, since no modulus has been used in the mathematical model, a negative value of P.C.F shall indicate a lower score given to style transformed images. This would point toward the absence of visual bias in the test case. Conversely, obtaining a positive value of P.C.F is taken as an indicator of positive bias existence since it would signal toward a positive difference as indicated by the equations above. Further, it is assumed that the larger the positive value of the P.C.F in magnitude, the more pronounced the visual bias correlation.

RESULTS



As indicated in the previous section, in order to mathematically obtain proof of bias existence, the use of a positive correlation factor was made. The positive correlation factor or the P.C.F here is defined using equations (i) and (ii) as specified in the preceding section. For illustration of bias existence, the final result of the study, one positive correlation factor value or P.C.F value per test subject was estimated. The graph below shows an illustration of the distribution of this P.C.F value. As can be seen, for a maximum number of data points, the value of the positive correlation factor or P.C.F is found to be between 4-5 and is strongly suggestive of a bias existence. The number of test case results for P.C.F in the range of 1-3, on the other hand, is significantly lower.

RESULTS

P.C.F range	Percentage of test cases
0-1	0%
1-2	5.5%
2-3	4.5%
3-4	30%
4-5	60%

The percentage distribution (approximate) of the test cases as a function of the P.C.F range is also illustrated on the left. All the test results are strongly indicative of the existence of a positive correlation between genre style transform and the subsequent user rating based on genre mapping. This helps conclude the tangible existence of a visual bias.

SCOPE



USER ENGAGEMENT

Methodology used eliminates the need to have multiple posters for diverse needs and can help generate bias-specific outputs.



COST REDUCTION

Generate bias-specific outputs and there would be no extra cost involvement.



COMPANY ASPECT

Online businesses increase the likelihood of product purchasing by making the user more inclined

CONCLUSIONS

We successfully presented empirical evidence of visual bias by illustrating the conducted study. Moreover, a methodology was put forth which may be employed in tandem with modern recommendation systems to utilize the bias thus detected. Favorable detection of visual bias as indicated by the study can go on to have many formidable implications.

The style transfer methodology used in the project may be extended to a web application utility in the future. This may help online businesses increase the likelihood of product purchasing. Streaming services like Netflix and the performance art companies may also serve to benefit. This is because the methodology used eliminates the need to have multiple posters to cater to diverse needs and can help generate bias-specific outputs that maximize user engagement. Similarly, the online advertising industry also stands to profit.

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THANK YOU!

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