Oh, Andrea. The Battle of the Book Cover/ https://tinyurl.com/y5hdwv9a

Everyone judges a book by its cover

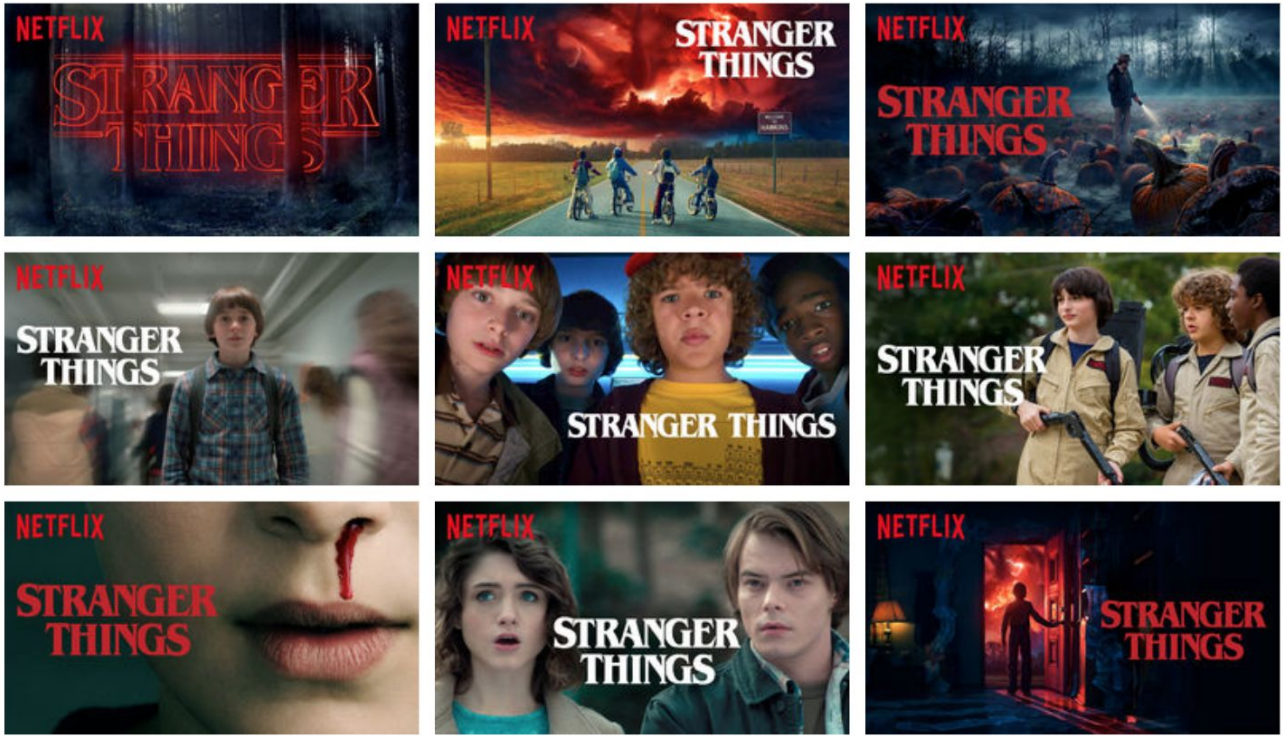
First interaction with the would-be reader

Often hire third-party designers:

"A book cover must first catch the eye of the reader, or else the book will never be opened. We think good design must be visually seductive—that might mean beautiful, or interesting, or weird, or new—but without enticing form, there is no entry point to content" - Anne Jordan and Mitch Goldstein

Jordan, Anne and Goldstein, Mitch. Uncovering the Cover Design. 2015. <https://tinyurl.com/yy4qmcjy>

Netflix, why do you get different thumbnails?



Chandrashkar, Ashok et al. Artwork Personalization at Netflix. 2017. <https://tinyurl.com/y7pl6jcd>

Netflix, why do you get different thumbnails?

"If the artwork representing a title captures something compelling to you, then it acts as a gateway into that title and gives you some visual "evidence" for why the title might be good for you. The artwork may highlight an actor that you recognize, capture an exciting moment like a car chase, or contain a dramatic scene that conveys the essence of a movie or TV show. If we present that perfect image on your homepage (and as they say: an image is worth a thousand words), then maybe, just maybe, you will give it a try."

Personalized recommendations and personalized artwork.

Previously attempt to find "best" thumbnail across all users with minimal success.

Chandrashkar, Ashok et al. Artwork Personalization at Netflix. 2017. <https://tinyurl.com/y7pl6jcd>

Goal: Suggestions or improvements

We propose using modern machine learning techniques to learn successful covers for books.

By doing so, we aim to discover whether certain elements of book covers are related to the eventual success of a book.

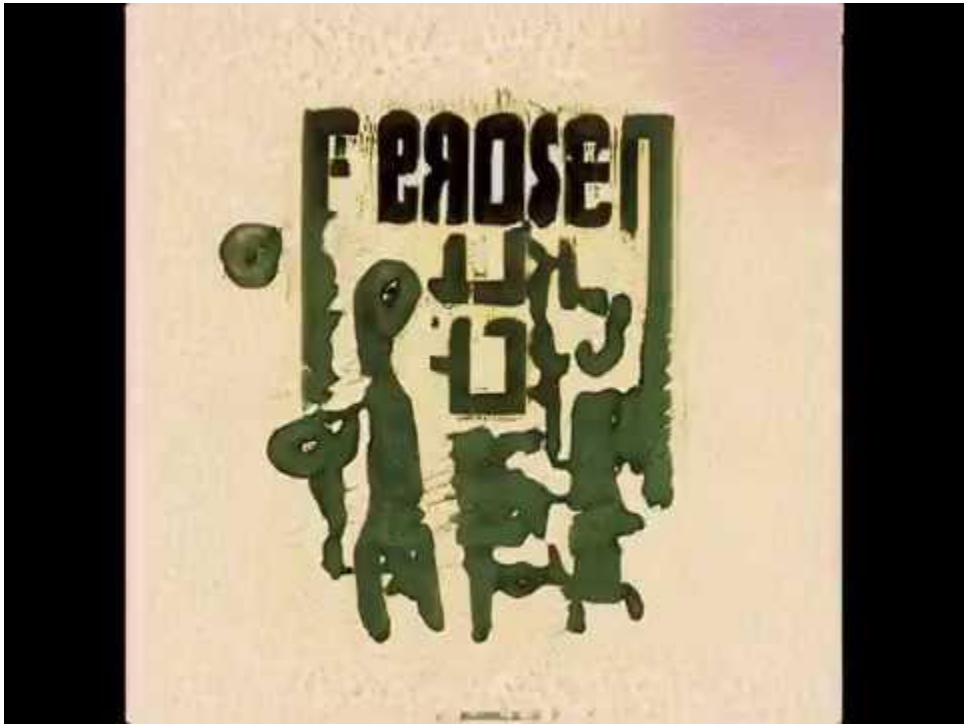
More importantly, knowing this information, can we generate suggestions to improve cover design?

Can we actually judge a book by its cover?

Why not generate a book cover?

Previous research intended to generate novel convincing album art covers given the lyrics of an album using generative adversarial networks to minimal success.

Title cannot be generated well, and further research is needed for 2d object extraction.



Hepburn, Alexander et al. Album Cover Generation from Genre Tags. 2017. <https://tinyurl.com/y2jexz8o>

Latent Patterns in previous work

Convolutional Neural Networks were used to learn categories of books simply based on cover. While the clustering was not perfect, we do see common traits among shared genres. This points to latent context we can rely on to build our model.

Iwana et al. Judging a Book by its Cover. 2017. <https://tinyurl.com/ppvbee3>

Data

Amazon review data: 51,311,621 reviews for 2,935,525 books

```
"[OVERALL RATING]","[VERIFIED]","[REVIEW TIME]","[REVIEWER ID]","[AMAZON INDEX (ASIN)]","[STYLE]",
"[REVIEWER NAME]","[REVIEW]","[SUMMARY]","[UNIX REVIEW TIME]"

"[CATEGORY]","[DESCRIPTION]","[TITLE]","[BRAND]","[RANK]","[ALSO_VIEW]","[MAIN_CATEGORY]","[PRICE]",
"[AMAZON INDEX (ASIN)]",
```

Categorized Amazon Book Cover dataset: 207,572 books in 32 classes

```
"[AMAZON INDEX (ASIN)]","[FILENAME]","[IMAGE URL]","[TITLE]","[AUTHOR]","[CATEGORY ID]","[CATEGORY]"
```

Methodology

1. Data collection and extracting useful information

2. Image feature extraction
   a. Traditional image processing to extract predefined features
   b. Convolutional Neural Network (CNN) Model

3. Recommendation engine
   a. k-NN for similar covers, CNN for predicted score
   b. From similar covers with better ratings, extract suggestions

Review/Metadata Extraction

Given book reviews and Amazon metadata:

- Consolidate reviews to get an overall rating weighted by number of reviews
- Extract book rankings and also bought books for relationships

Ratings

Job information | Results | JSON | Execution details

Row	total_reviews	rating	ASIN
1	115455.0	3.984641932700604	038568231X
2	91711.0	4.105053489100756	B000X1MX7E
3	88491.0	4.76244550885313	0312577222
4	87513.0	4.683847141939627	B003156C4E
5	87279.0	4.683857464849201	B001C4VLZQ

Rankings

Row	ASIN	ranking	also_bought
1	B01HI5V3HI	3921775	
2	B01HIP8KLU	2655897	
3	B01HJ0AYR2	583884	B078V7G3XY,B01M0C8BVU,B0747HDXCX,B00L43QLD2,B00VEE42DW,B012JPGK3E,B01MR8C5PW,B01EH10DAE,B009B2YKTU,B00L1BBW4A,B00RHCX25O,B005T54LCY,B00MMNTO14,B014OL8SG8,B00SQ4DLBM,B00IFSU3OM,B009FR9CCG,B01L0Y8P2O,B01B5BMVXQ,B00CENJB5G,B01L0Y8P1A,B008MM8SBG,B00DPZZVBU,B07DMZB97R,B00FD9WT2A,B07CQ7P24Y,B009CQG9T4,B00KP8DA72,B07JWFDM2F,B004RKXHEU,B07HDMC4GH,B07KGDDW7J,B07B26JHMD,B07FCQV31V,B077WXP3KG,B076X2TNRM,B002G54Y2M,B06XCM8VPB,B079KX1XFD,B078CY7TLY,B078X12Y75,B074N1XJR2,B07BR6RNS3,B07BK3M7V7,B01EROMI1S,B074PD2QR3,B07D4M7N3L,B071X2K4S6,B075C9TMR1,B002361LHU,B002DW92V6,B01H03IBHS,B01MRF794N,B00OBT9B60,B0783P29QP,B01NCU3JYC,B00UI4ERXY,B075JGPRR5,B07634GR5R,B000OCXHT0,B01L9W8CYI,B00KWFZ7CE
4	B00T3PMFHO	1103611	B004G8PIOA,B007WKFMGS
5	B00T884AME	126974	B01D6RFQPC,B01NC30DNW,B07652YGR9,B01CNZV0Q2,B01BIFXV88,B07CK1MRPJ,B00PMVTNQO,B01N3QYKNX,B073W9DBPS,B075KS2V9N,B07BBX3FMN,B01A86GUTK,B07CZBV5LQ,B07K4TS4SR,B00KECZLG2,B01N6SFVMS,B00I5Q71YE,B07D67FG2H,B010XQ4WDG,B01FIJKZNY,B00LKGBK2A,B01MY9ZP2W,B07K1FJ75F,B077X4LQ1S,B01MYC4RV7,B07FZTSFXY,B00ZJG398U,B01NAB6G4W,B013CFG1HA,B072L1NZ16,B07GHYQ4T1,B008Y0XH1C,B00WHXYZG8,B01BECUPJS,B0793X6RJQ,B01A7RJ94S,B00495Z8E0,B07HLC6R6L,B077T898H9,B01LVXR8M8,B07L5R5KWZ,B076HKP2PM,B07D8JM9W9,B0153IIWDK,B00NCYZ2M2,B0166SHTVM,B00OO5IN1A,B07BX14NRW,B01JX6EFKW,B00EBC0ZFI,B074WXMKVJ,B008ZEDO06,B017RMH4GG,B07CZNC58K,B078RQNCDT,B00MX0EC8G,B01MT3UWAM,B005SGCD6A,B00CFQJNKA,B00LB6DKD6,B000O2U9AFA,B008H7CEQG,B019SK5IRW,B000OVLIQU,B01DLBGDSC,B005FVPFEK,B01N27XYYO,B07FH84SVH,B075LYJWN5,B01FUV0WJW,B00JUUZOD4,B00HGB70WM,B00YQKID04,B01M662J9X,B0130L

Image Feature Extraction

We will explore both traditional generating features and training a CNN to automatically select features.

Manually generated features may include those based on the cover's:

- Color (most common color, how many colors, etc.)
- Text (content of text, size of font, etc.)
- Blobs (recognizable shapes, amount of separate objects, etc.)

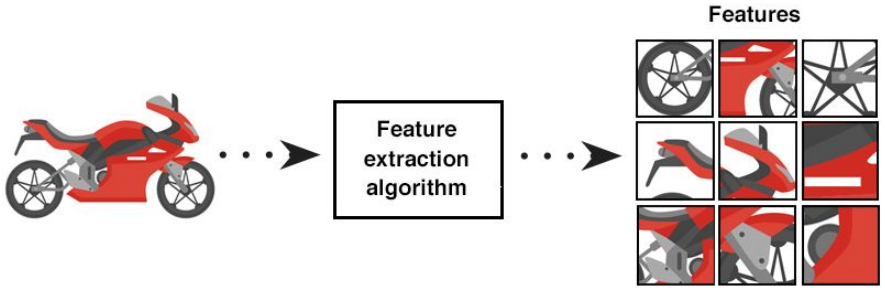
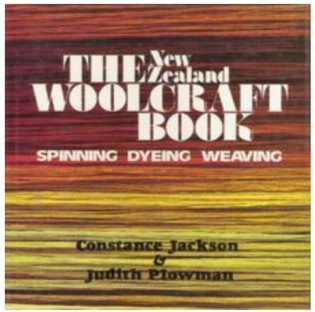


Image Feature Extraction

Three simple image features extracted for MVP

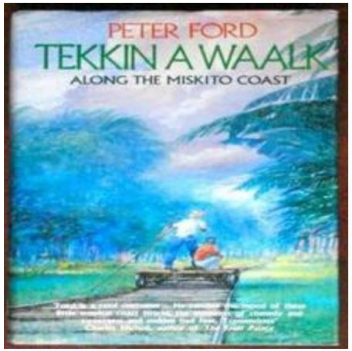
1. Dominant Color
   a. K-means clustering on pixel RGB values to group top 5 colors. Choose mean of largest cluster
2. Brightness
   a. RMS of all the pixel values
3. Colorfulness
   a. Metric evaluating the variation in RGB values



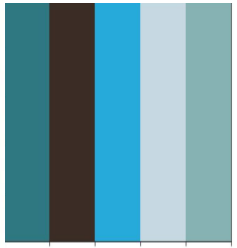
Top 5 Colors

Colorfullness
65.36

Brightness
119.04



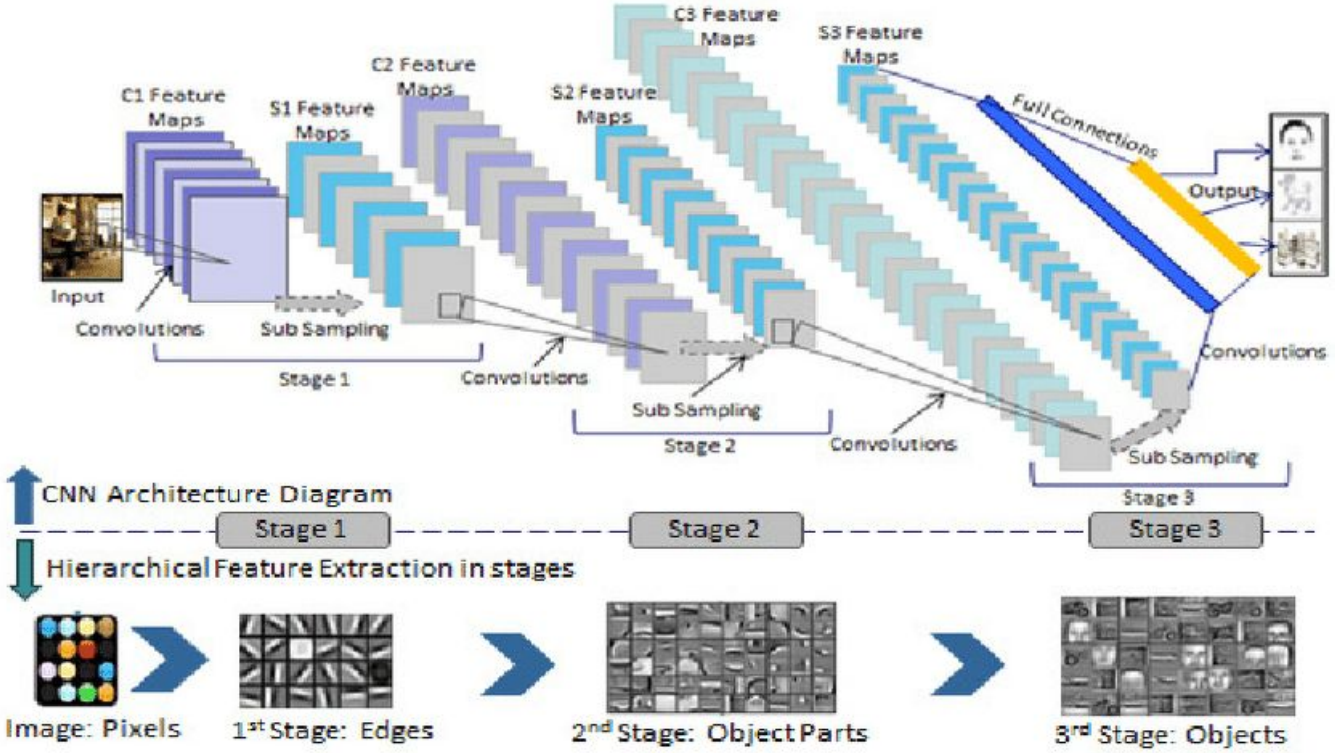
Top 5 Colors



Colorfullness
90.76

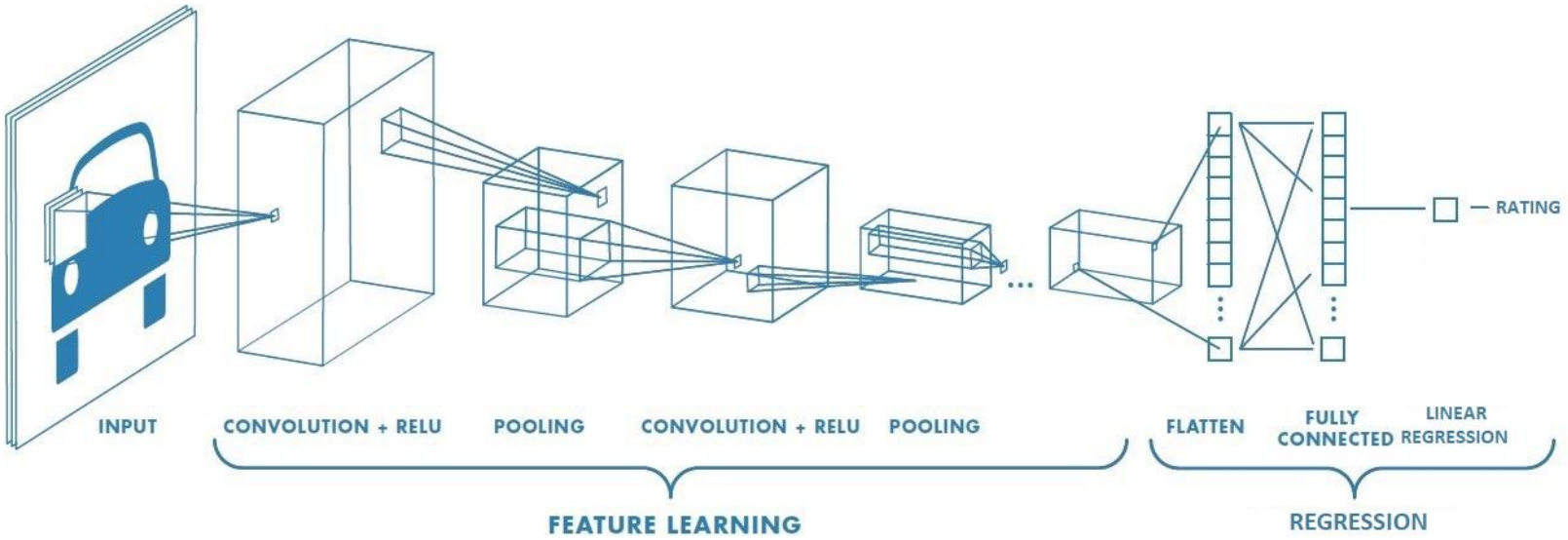
Brightness
158.97

Convolutional Neural Network



Katole et al. Hierarchical Deep Learning Architecture For 10K Objects Classification. 2015. <https://tinyurl.com/y25de298>

Convolutional Neural Network



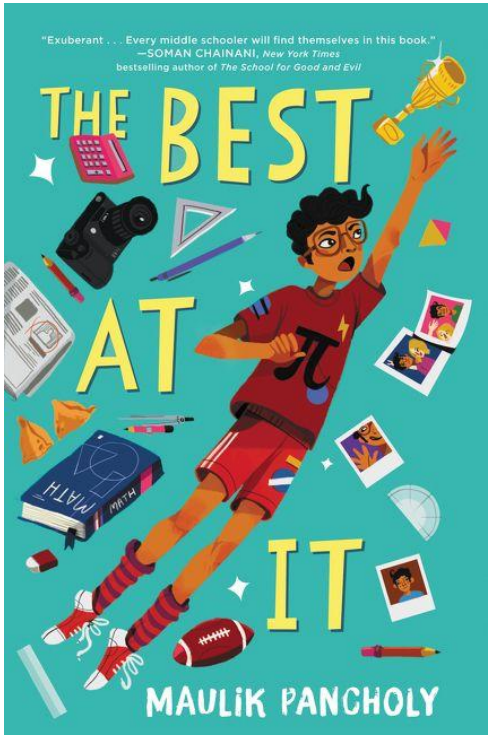
- Rating predictions on the testing data were on average within 6.79% (+/- 0.34 stars) of the actual rating. This shows there's a relationship between cover and overall rating of a book.

Recommendation Engine

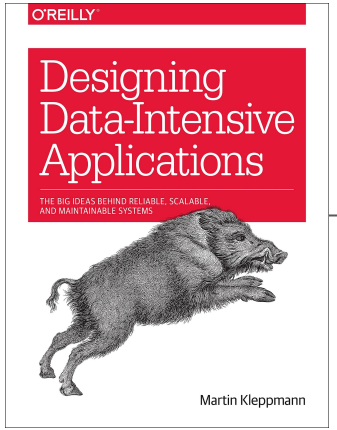
Based on our extracted features (traditional and CNN-generated) we can find example covers by looking for cover images with similar features.

We correlate this collection of images with an average review score out of 5 stars to suggest what we think the book related to this book cover might be rated.

We also suggest tweaks to the cover that would change the book cover to be in a category that has higher average reviews.



Recommendation Engine Example



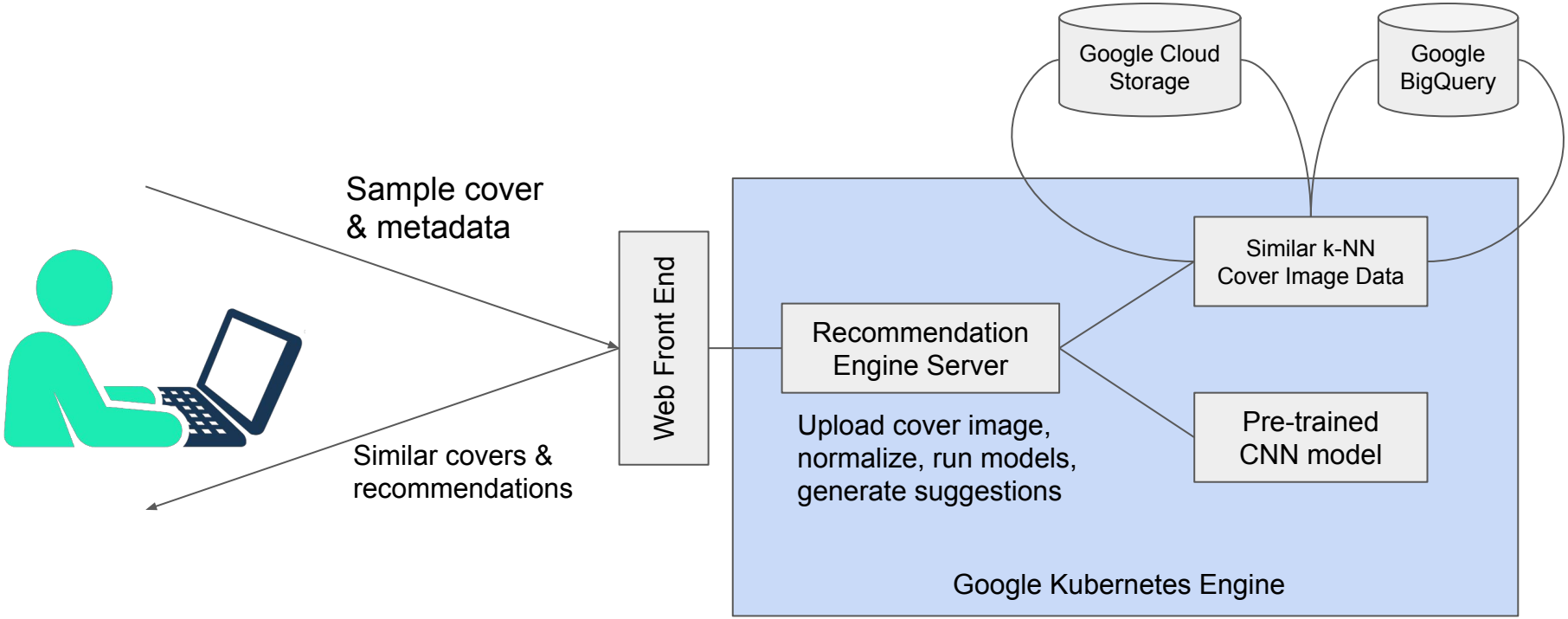
Recommendation Engine

Similar Covers:

Expected Rating: 4.45

Suggested Tweak: Your book cover may do better if it were more colorful

System

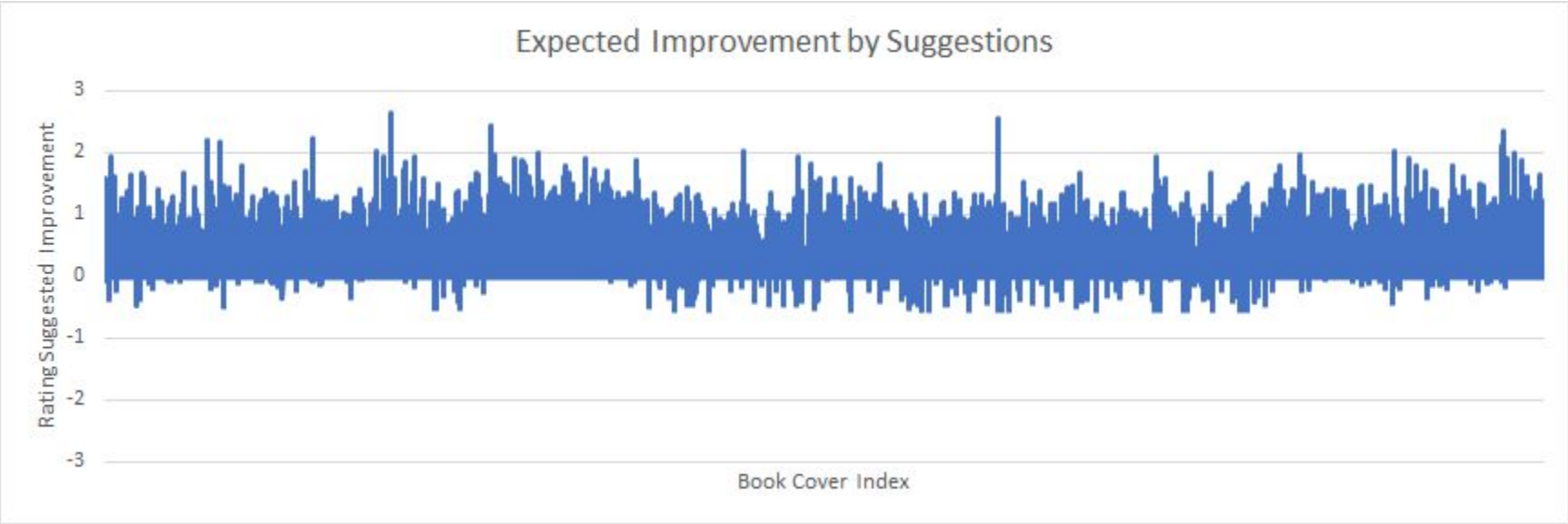

Google Cloud Storage
Google BigQuery
Sample cover & metadata
Web Front End
Similar k-NN Cover Image Data
Recommendation Engine Server
Pre-trained CNN model
Upload cover image, normalize, run models, generate suggestions
Similar covers & recommendations
Google Kubernetes Engine

System

- All code managed in GitHub
- All team communication and coordination through Slack
- Feature data and metadata trained using Google Dataproc
- Simple frontend (pure html)
- Backend Flask app running pre-trained Keras/SKLearn models
- Docker images built on Google Cloud Build
- Deployed via Kubernetes on Google Kubernetes Engine
- Grabs images from Google Cloud Storage
- Grab metadata from Google BigQuery

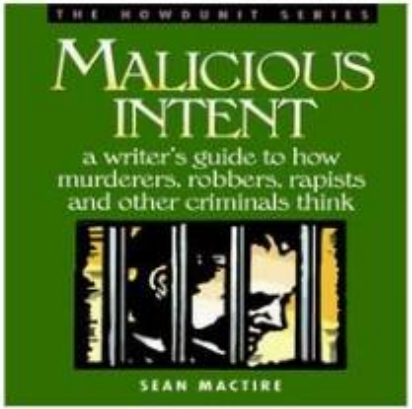
Results

Our engine provided suggestions for improvements on 29484 book covers, or 51.7% of our dataset, with an average expected rating increase of 0.322.



Results

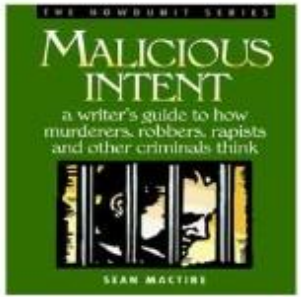
Candidate Cover



Suggestion:

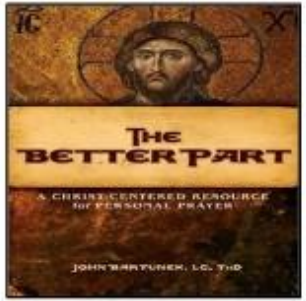
You should make the book cover less bright.

Similars covers

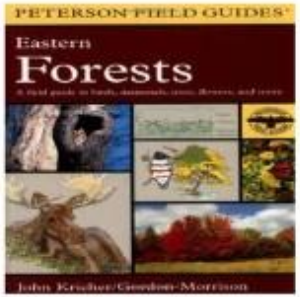


rating = 2.75

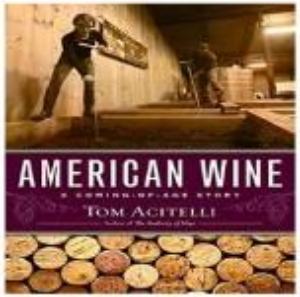
rating = 4.83



rating = 4.94



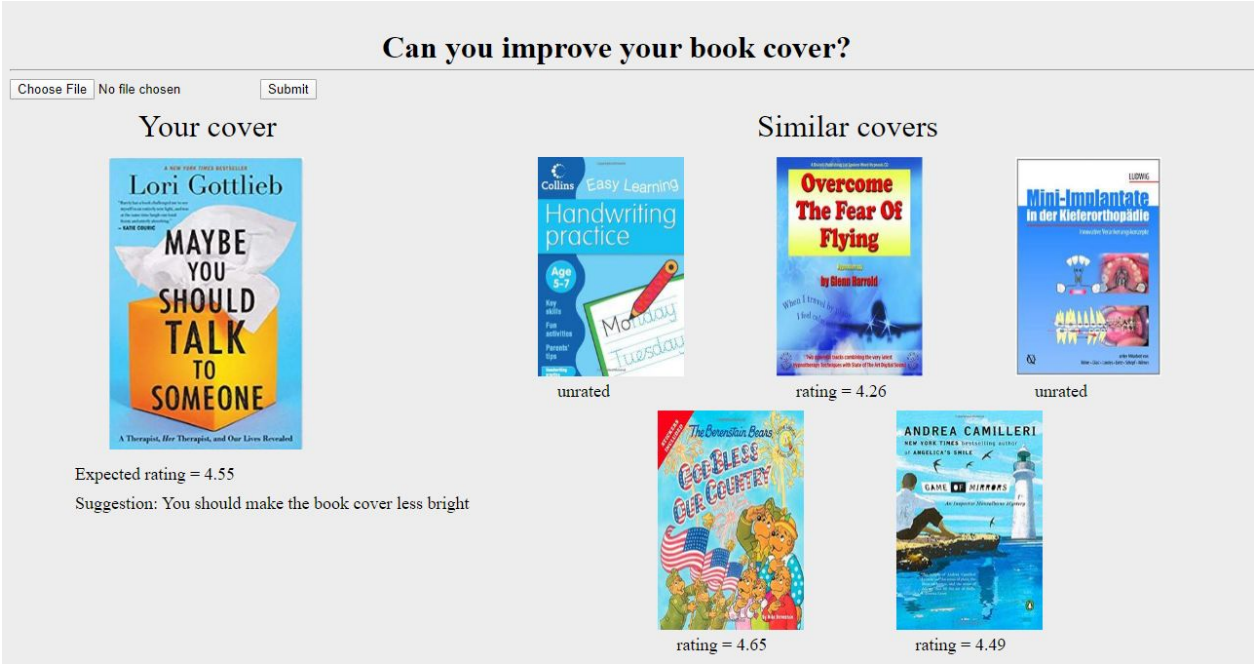
unrated



rating = 4.17

Demo!

http://35.222.73.123/

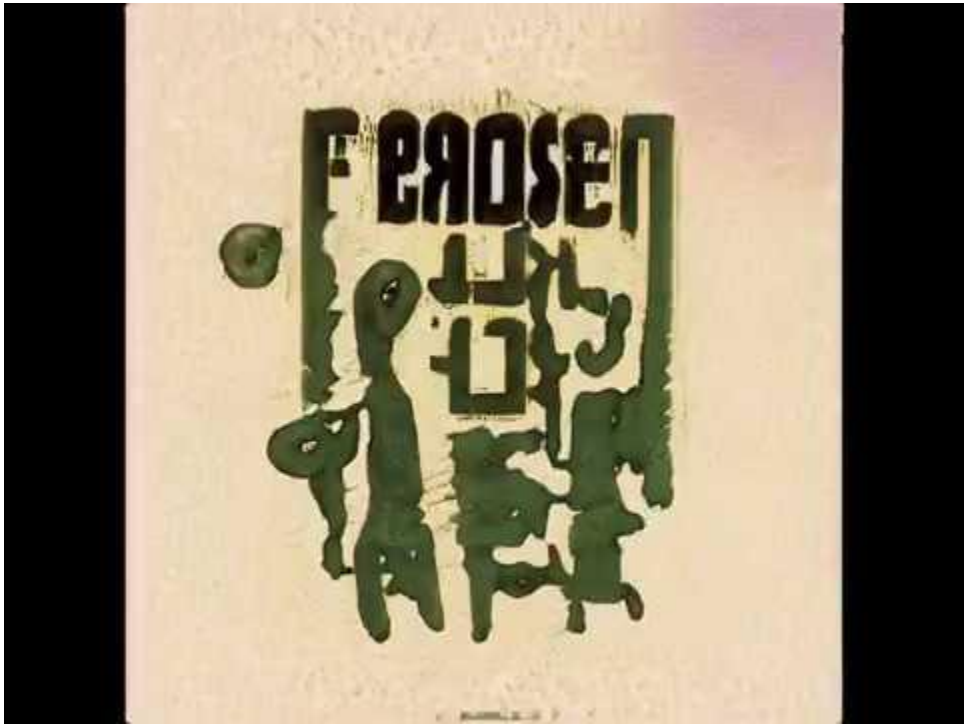


Future Work

Number of wishlist items:

- Combine CNN with metadata model (publisher, author, etc)
- Use typeface and font detection
- Augment with genre, title, and topical popularity
- Augment with actual sales figures
- Automatically edit cover with suggestions on recommendation engine server
- NLP on review text to tease out best and worst comment for similar books, analyze whether it impacts cover design
- NLP on actual book text and compare successfulness

Any Questions?



Hepburn, Alexander et al. Album Cover Generation from Genre Tags. 2017. <https://tinyurl.com/y2jexz8o>

Thank you!

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