Smithsonian
Cooper-Hewitt, National Design Museum

AK

THE TRAILS IN US

PATTERNS OF HUMAN BEHAVIOR

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THE PEN ARRIVES

WHY THE PEN

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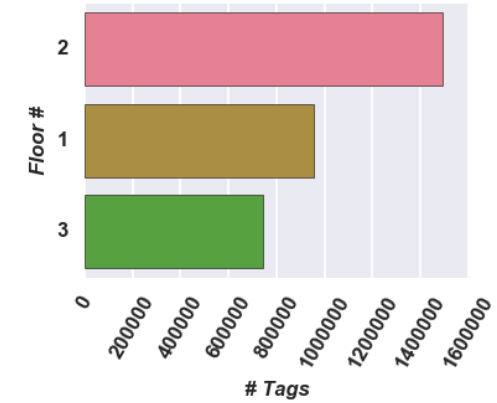
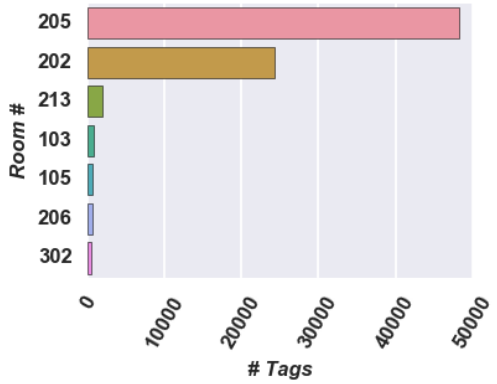
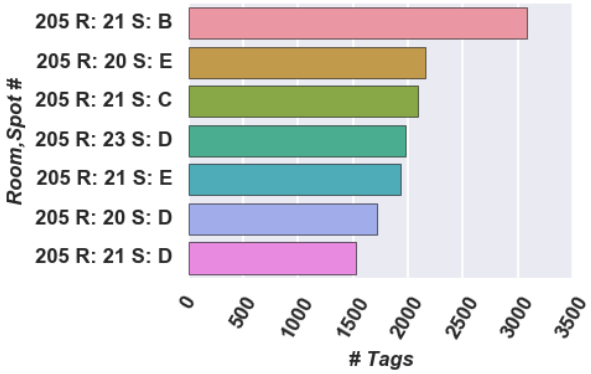
- ENHANCE VISITOR EXPERIENCE
  - DRAW VISITOR INTO THE *DESIGN EXPERIENCE*
- RECENTLY RELEASED DATASET (MAR 2016)
  - 3.5M+ OBSERVATIONS
  - AGGREGATE W/COLLECTION METADATA (80K+)
- PROJECT FOCUS:
  - VISITOR SEQUENCE PATTERN TAGGING BEHAVIOR
  - IDENTIFYING SEGMENTS BASED ON VISITORS TAG BEHAVIOR

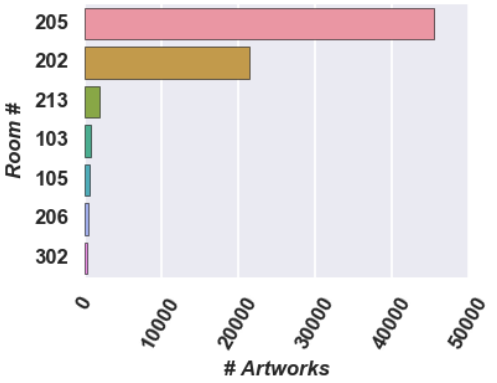
LOVE THY DATA

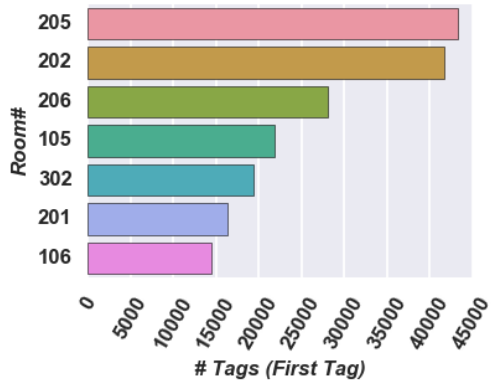
AK

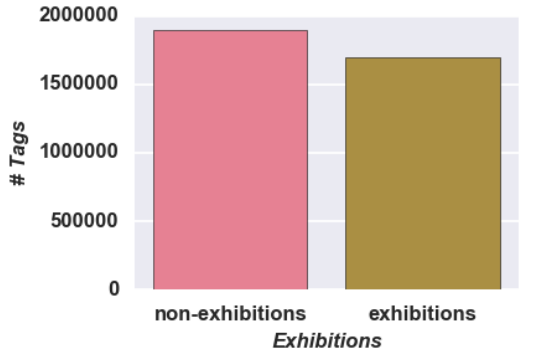


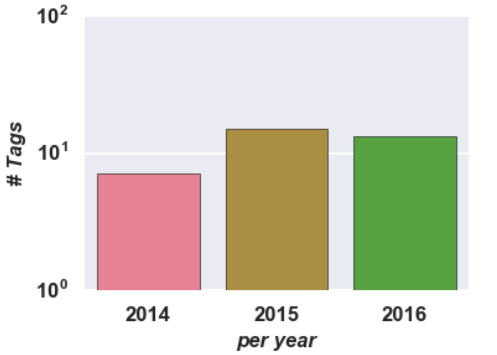


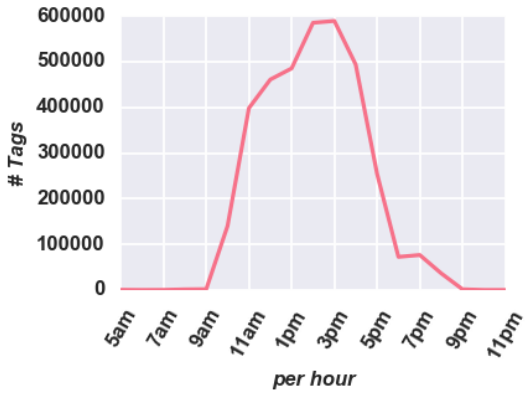


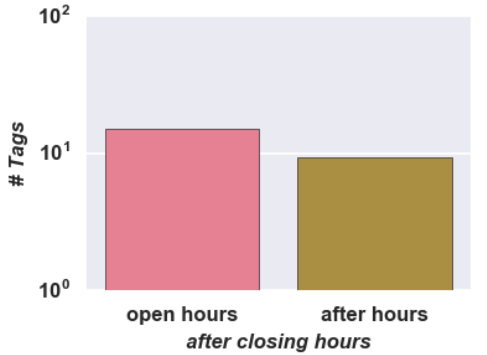












- HIGH CAPACITY ROOMS
  - RM 205,202
- FIRST ARRIVAL
  - RM 205, 206, 202
- EXHIBITIONS
  - INFERRED FROM VISITOR BUNDLES
- AFTER HOURS
  - MUSEUM TESTING DATA
  - SPECIAL EVENTS

PAGE RANK

TOP 10 INFLUENTIAL ARTWORKS BASED ON A VISITOR'S DAILY JOURNEY

MODELING THE SEQUENCES

RM 206

RM 212/105

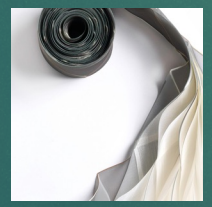
RM 201

RM 212/105

RM 201

RM 212/105

RM 302



RM 206

RM 105

RM 302

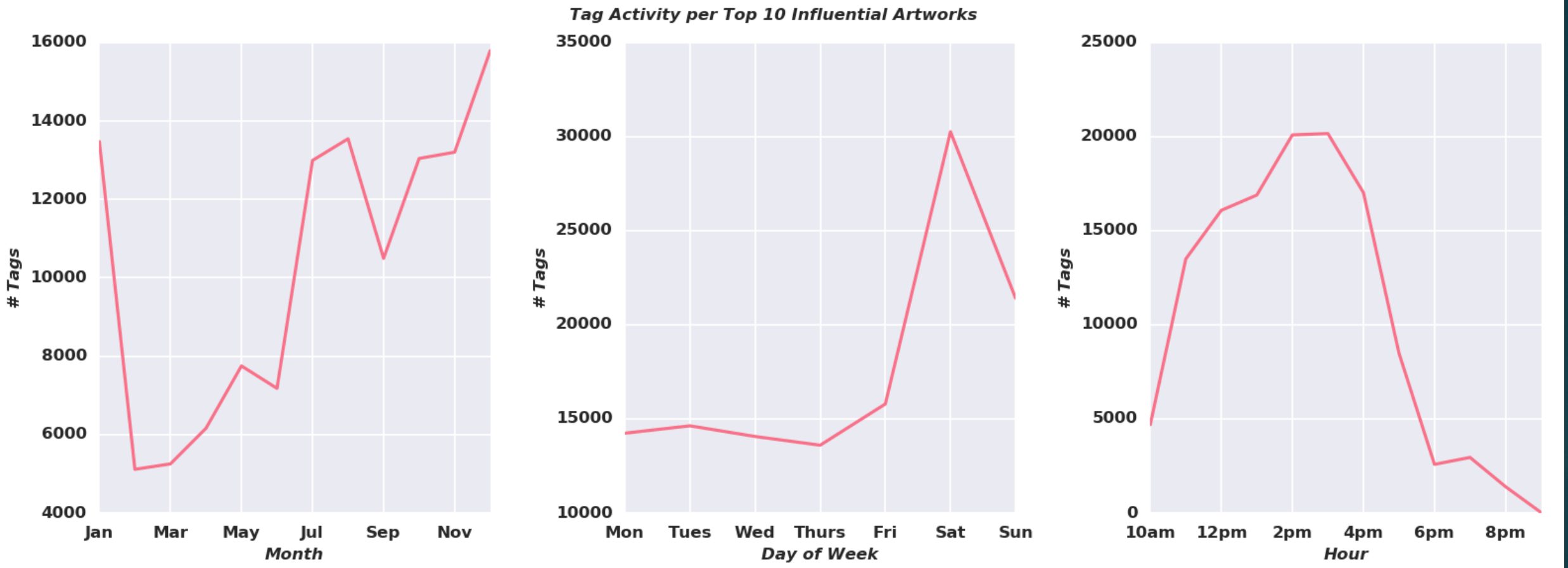
GROUP A DAILY JOURNEY AS A DIRECTED SEQUENCE

- COMMON THEMES
  - STAIRCASES
  - MURALS, POSTERS
  - TEXTILES
- MOST CENTRAL ARTWORK
  - DRAWINGS
- TRANSITION LOCATIONS
  - POSTERS (RM 202, 205)
  - DRAWINGS (RM 202, 205)
  - CONCEPT ART (RM 103)
- % OVERALL TAGS: ~ 3%
- % EXHIBITS: 30%

Images accredited to Cooper Hewitt Design Museum

PERIODS OF ACTIVITY

Per Top 10 Influential Artworks

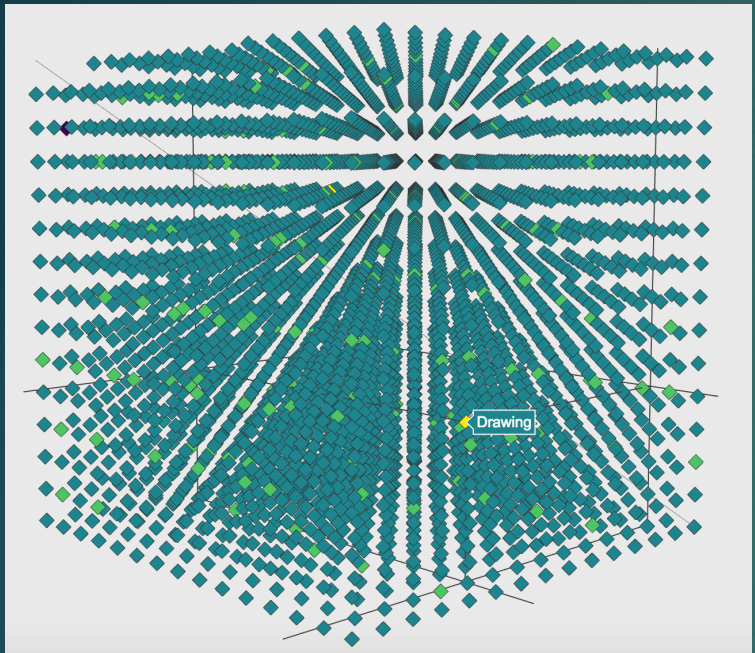


SEASONAL PEAKS: SUMMER, WINTER

WEEKEND PEAKS

AFTERNOON PEAKS: 2-4 PM

GRAPH BASED COMMUNITIES
LABEL PROPAGATION ALGORITHM (LPA)



SAMPLING COMMUNITY DETECTION

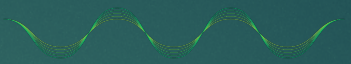
DENSE COMMUNITY	SMALL COMMUNITY
HIGH CAPACITY ROOMS (RM 205,202) THEME ROOMS (1st FLOOR: PROCESS LAB)	SMALL CAPACITY ROOMS SPECIFIC TO 3RD FLOOR (302)
TYPES OF ARTWORK: POSTERS/DRAWINGS/ CONCEPT ART	TYPES OF ARTWORK: VESSELS/ SKETCHES/PRINTS
DEPT: DRAWINGS/PRODUCT DESIGN/...	DEPT: PRODUCT DESIGN
EVEN DISTRIBUTION OF EXHIBITIONS	N/A
AFTER HOURS SPECIAL EVENTS	N/A

- ONE LARGE DENSE COMMUNITY
- ONE SMALL COMMUNITY
- SEVERAL SMALL MICRO-COMMUNITIES

DRAWBACK OF LPA: SINGLE DENSE COMMUNITY
WE CAN DO BETTER…

TEMPORAL PATTERNS

ADDING MORE CONTEXT TO SEQUENCES



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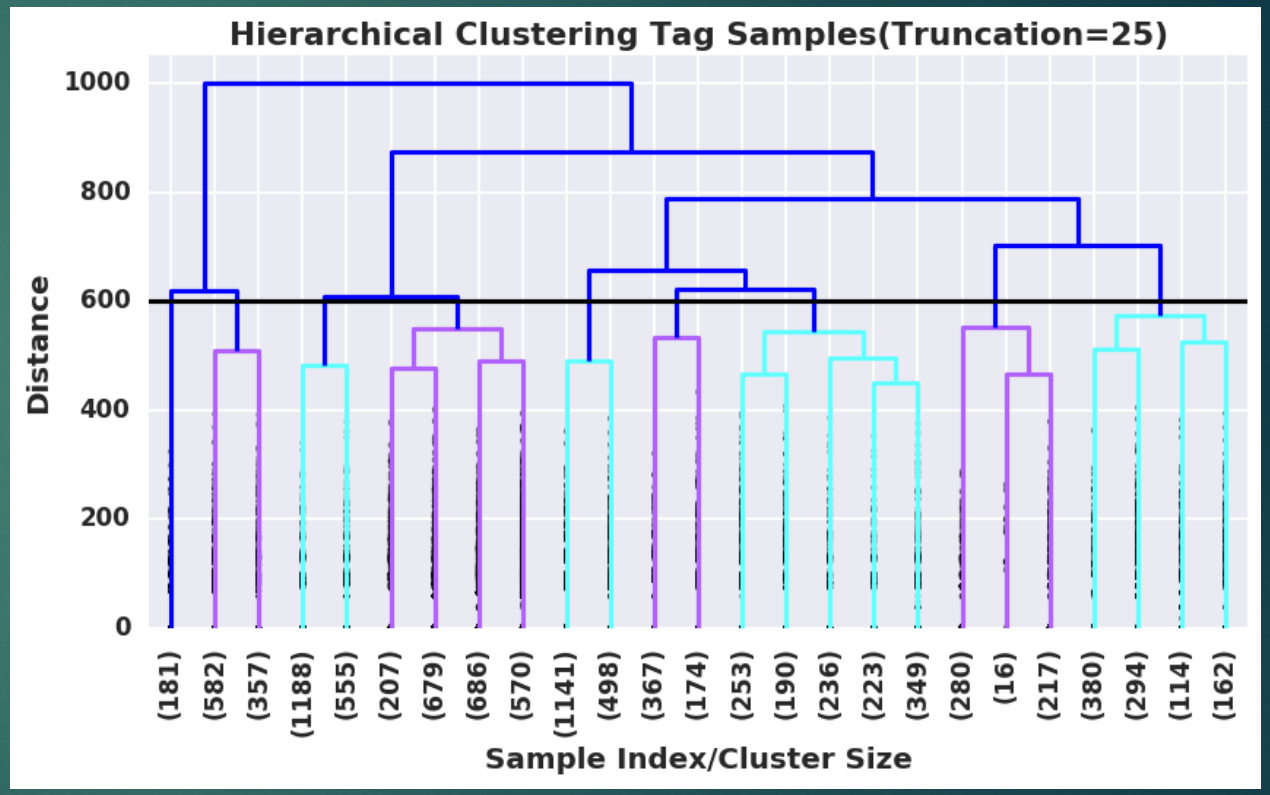
FEATURE ENGINEERING

- BURSTY VISITOR SEGMENTS
  - RESAMPLED TIME PERIOD SEQUENCES
  - AS OUTLIERS BASED ON MOVING AVERAGE (MA) WINDOW
- ACTIVITY TIME PERIODS
  - PEAK HOURS, DAY OF WEEK, TIME OF YEAR
- ARTWORK LOCATIONS
  - ARTWORKS WITH MULTIPLE LOCATIONS BASED ON TIME PERIOD
  - SPOT LOCATIONS WITH A LARGE TURNOVERS
  - CAPACITY BASED ROOMS
- ASSOCIATE VISITOR TAG TO AN EXHIBITION

HIEARCHICAL CLUSTERING

BASED ON TEMPORAL PATTERNS

- IDENTIFIED CLUSTERS
  - FLOORS
  - ARTWORK ROOM CAPACITY
  - HIGH VS CONSTANT SPOT TURNOVER
  - VISITOR STATION REGION AREAS
  - SPECIAL EVENTS (AFTER HOURS)



- ALL DATA IS CATEGORICAL/BINARY
  - KMEANS NOT A GOOD FIT
  - CITYBLOCK > COSINE > HAMMING > JACCARD
  - COPH DISTANCE (CITYBLOCK) ~ 0.73

BIG DATA
CAN IT SCALE

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TRANSFORMATIONS

SUB-SAMPLE

LAYOUTS/VISUALIZE

FEATURE ENGINEERING

RECOMMENDATIONS

HOW TO HELP THE MUSEUM

- FURTHER IMPROVE VISITOR EXPERIENCE – NO MISSED OPPORTUNITIES
- OPPORTUNITY TO IMPROVE ON TRANSITION SPOT LOCATIONS
- TAILORED VISITOR SEGMENTATIONS

FUTURE VISION

- ADDITIONAL MODELING ON MEMORY SEQUENCES (RNN/LSTM)
- FEATURE ENGINEERING ON ANNOTATED METADATA (NLP)
- TRANSFER LEARNING (APPLY TO OTHER DOMAINS)

DISCUSSION

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Appendix

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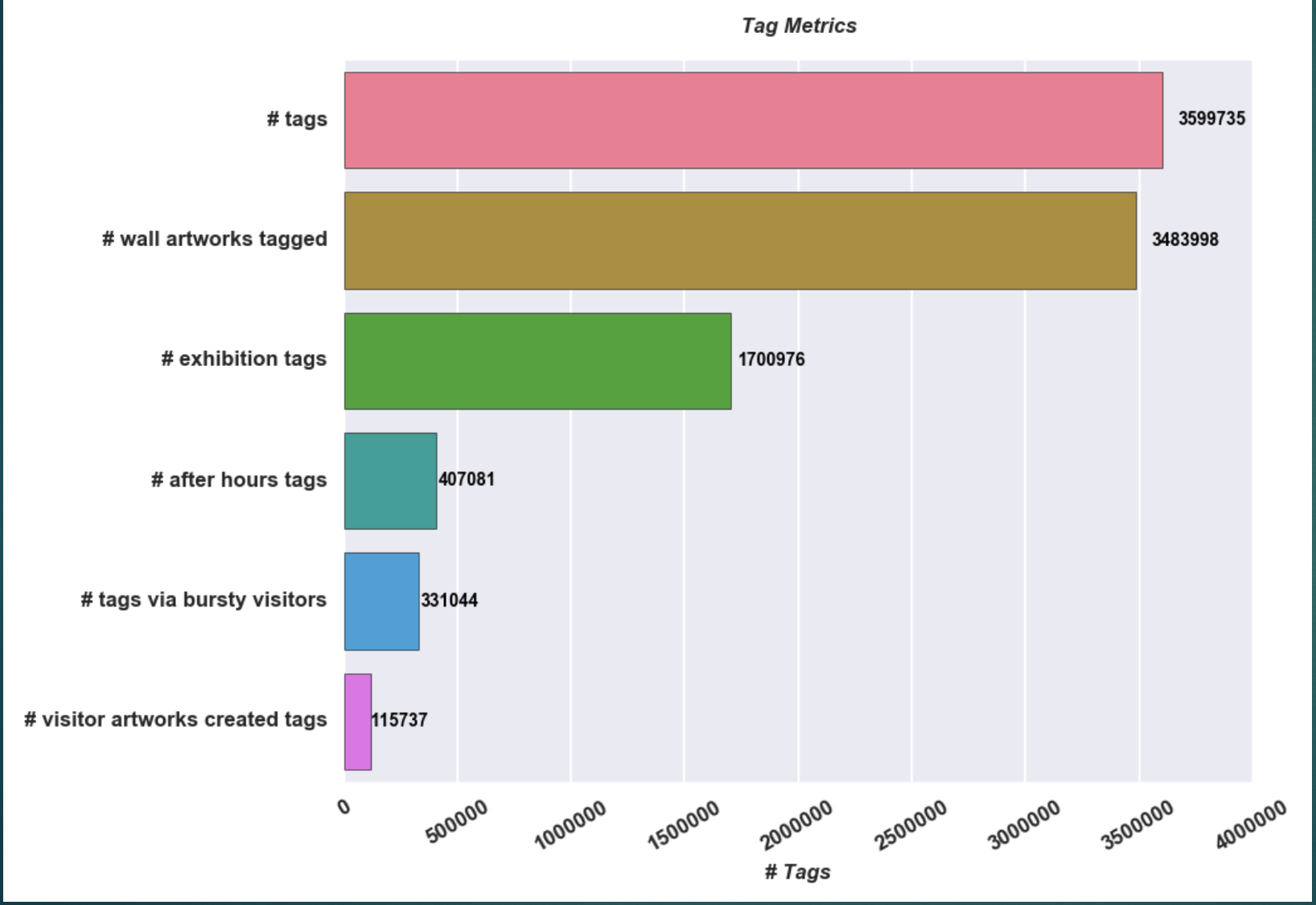
ADDITIONAL METRICS



METRIC	MEASURE
# AVG DAILY TAGS	32
# UNIQUE ARTWORKS WITHIN COLLECTION	3895
# UNIQUE VISITORS	111467
# UNIQUE BURSTY VISITORS	14455

COMPONENTS

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NON-DISTRIBUTED

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DISTRIBUTED