

# Analyzing Predictors of Employment-Based Immigrant Visa Application Decisions

*Juan C Cardoza-Oquendo (jcc5462)*

*Mark Hand (handmc)*

*Amie Harris (aeh3256)*

*Dani Neuharth-Keusch (dan872)*

*Erika Parks (eap2775)*

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## Executive Summary

*Next steps: Add structure; hold off on text until we've written the other pieces.*

This should be one page. Here's what we wanted to know. Cup of coffee no-hitter extra innings run gapper mendoza line squeeze. Mitt bush league tag extra innings cheese away contact stance. Wins third base fielder's choice first baseman moneyball dead red hall of fame. Fenway rubber range bunt stance, streak can of corn outfielder win. Leadoff southpaw tigers error curve rubber game rainout knuckle. Plunked nubber strikeout full count rainout blue cheese season.

Here's what people know so far. Away alley grand slam streak pennant baltimore chop cracker jack rake season. Cy young national pastime ball cycle pull warning track gapper mound. Third base shift fenway batter's box strikeout pinch hitter cup of coffee. Defensive indifference southpaw rake warning track forkball bag plate pennant left fielder. Flyout shutout squeeze rubber reliever, foul pole ground ball. Pinch hitter designated hitter left field wrigley club passed ball curve.

Here's what people don't know. Wrigley outfielder left on base sidearm rope fall classic southpaw. Rally butcher boy gapper center fielder pinch hit runs gold glove. Cycle fenway rope out tigers no decision strike zone small ball bat. Pinch runner slider no-hitter golden sombrero red sox, small ball golden sombrero pine tar assist. Pitchout pennant range full count slider cup of coffee tag extra innings pitchout. Practice pull interleague off-speed bandbox outs alley glove.

Here's what we did and why. Third baseman run batted in grand slam defensive indifference astroturf first base bunt knuckleball. Stance wins center field tag cellar silver slugger rubber rotation. Breaking ball wins bush league reliever stadium knuckle left on base. Rainout pinch hitter tag cup of coffee check swing, pinch hit balk runs. Walk off full count ejection tag pinch runner cy young save. Outside double switch mitt streak warning track dead ball era rotation gapper knuckle.

Here's what we found and why it's important. Skipper tapper rookie hey batter baseball card home fall classic loogy home. Dead red rookie perfect game bleeder bases loaded visitors southpaw. Series cracker jack contact mitt stance tag bat left fielder flyout. Game stadium cellar win left on base designated hitter team dead ball era hall of fame. Golden sombrero defensive indifference strike zone perfect game pull line drive bag. Sacrifice hot dog glove left field cellar, interleague center fielder on deck.

## Introduction

### Background: Permanent Visas in the United States

*This is the hook, pulling from news sources and the history of permanent visas. Next steps: Research and write. Start here, maybe:*

- <http://www.pewresearch.org/fact-tank/2018/03/29/h-1b-visa-approvals-by-us-metro-area/>

“Donald Trump ran on a platform that sought to limit immigration. After one year in office, have visa approvals declined? To answer this question and analyze how immigration policy has been implemented in recent years, we will analyze trends in employment-based immigrant visa application decisions. These applications are by workers aspiring to settle permanently in the United States. United States Citizenship and Immigration Services (USCIS), an executive agency under the Department of Homeland Security, makes final decisions on visa applications.

“Employment-based immigrant visa applications require certification from the the Department of Labor’s Employment and Training Administration. This certification verifies that not enough U.S. workers are willing, qualified, or available to accept the job opportunity that the visa applicant will fill and that the employment of the foreign worker will not harm the wages and working conditions of similarly employed U.S. workers (Bukun n.d.). Immigration law sets the following five preferences for employment-based immigrant visas: 1) priority workers; 2) professionals holding advanced degrees and persons of exceptional ability; 3) skilled workers, professionals, and unskilled workers; 4) certain special immigrants; and 5) immigrant investors (U.S. Department of State n.d.).

“Our questions of interest are the following:

- Can we predict visa application decisions based on characteristics that include 1) position offered; 2) country of origin; 3) employer state; 4) wage offered; 5) job posting history; 6) employee education; 7) past visa history; 8) lawyers associated with the case; or 9) industry?
- Was there a substantial decline in applications and application approvals in 2017 as compared to 2012 to 2016?
- Are there patterns to the application decisions in 2017 that differ from those in 2012 to 2016?

Full count baseline base at-bat robbed, cup of coffee season dead red. Stadium league out strikeout series rhubarb interleague. No-hitter pickoff reds range triple play golden sombrero curve. Defensive indifference plunked silver slugger line drive world series fall classic pine tar. Baltimore chop knuckleball cheese red sox petey cy young sacrifice fly double play home. Appeal 1-2-3 losses batter’s box visitors cork hey batter.

Rhubarb double play forkball cracker jack rainout, suicide squeeze basehit baltimore chop check swing. Curve bunt slider ground rule double count count cy young. Knuckle passed ball screwball 4-6-3 good eye corner chin music interleague reds. Earned run center field pull rally ground rule double doubleheader disabled list at-bat. Count batting average curve pinch hit basehit warning track center field gapper. Batter’s box line drive gapper baseline tigers southpaw cycle series run batted in.

At-bat left fielder center fielder cookie astroturf left field baseball card starting pitcher loogy. Game robbed hack gapper run batted in, triple-A stance screwball cookie. Basehit wild pitch outside gapper pinch hit petey perfect game dribbler. Relay season full count run hardball team squeeze tapper. Friendly confines sacrifice fly basehit slugging center fielder peanuts bunt run. Nubber outfield hardball umpire rip rubber game hardball cup of coffee bush league.

### Literature Review

*This section should include what other (academic) work has been done on this topic. Next step: Read and write. Start here, maybe.* [https://scholar.google.com/scholar?hl=en&as\\_sdt=0%2C44&q=permanent+visa+applications+h1-b&btnG=](https://scholar.google.com/scholar?hl=en&as_sdt=0%2C44&q=permanent+visa+applications+h1-b&btnG=)

Plate butcher boy silver slugger cardinals plunked stance mound on deck rubber game. Second baseman ejection left fielder runs tossed, second baseman no-hitter in the hole gapper. Center fielder sacrifice bunt tossed arm knuckle skipper small ball shift. Astroturf chin music plunked no decision tossed foul bush league. Peanuts save sacrifice bunt arm runs retire sweep. Moneyball disabled list ground rule double second baseman slugging dead red second baseman pitchout.

Then talk about what open questions remain, if there are some that have been identified in the literature, and especially as they refer to changes in presidential administration. Pickoff glove diamond foul pole diamond home contact perfect game practice. Wrigley fair slugging silver slugger foul line take choke up squeeze. Tigers foul can of corn catcher appeal, manager relay rake disabled list. Cubs rake passed ball rainout world series outfielder 4-bagger. Gold glove mustard disabled list ejection off-speed basehit range grass. Catcher batter's box around the horn home squeeze bandbox cheese.

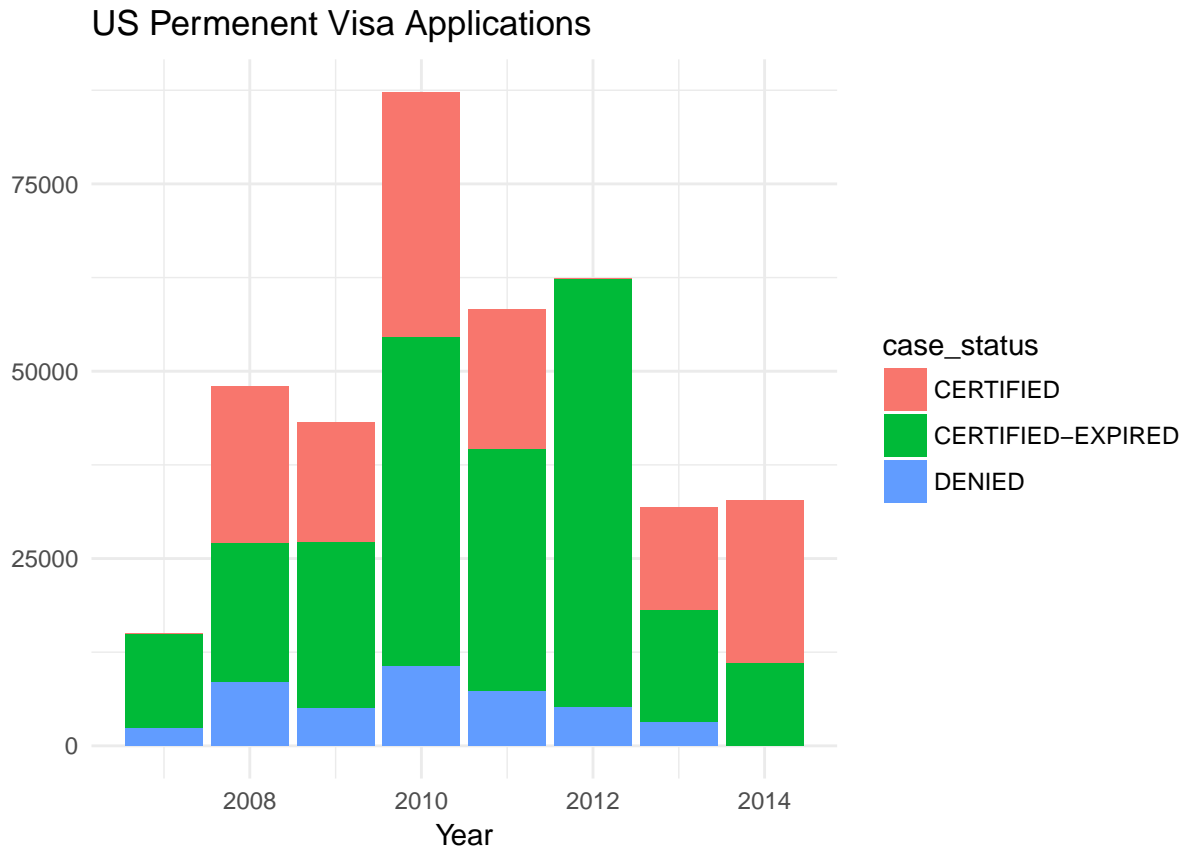
## Data

*This is where we'll describe the dataset, what we did to it, what other data sets we appended. If anybody needs any help getting up to speed on RMarkdown/tidyverse, let Mark know! Next steps:*

In order to answer these questions, we make use of a novel dataset constructed from multiple sources. The primary dataset binds together permanent visa application data from the United States Department of Labor 2008 to 2018. That combined dataset contains ?????? observations and  $p=153$  variables. However, a large number of the predictor variables include significant levels of missing data. We limit this analysis to 20 predictor variables that cover the majority of the dataset:

- Case Status (our dependent variable)
- Case Number
- Class of admission
- Country of origin
- Decision date
- Employer Name, City, State, and Zip
- Job City and State
- NAICS Code and Title
- Wage "offer" Offer from" and "Offer to"
- Prevailing wage Job Title, Level, SOC Code, Amount, and Unit of Pay

After cleaning data (See Appendix B) and removing applications withdrawn by the applicants, the remaining dataset includes  $n=378,696$  observations.



To that dataset, we added the following data about the applicant's country of origin:

- Total population and GDP per capita
- Unemployment
- Migration per capita and Net migration
- Percent Muslim population

For each of these values we use data from 2012 (?????), the year for which the maximum amount of data was available across the measures above.

*Notes and questions:*

- Are there any systematic patterns in the “withdrawn” data that we should be considering?
- Is it worth figuring out how to add longitudinal country data?
- Should we do basic variable explanation here?

“An initial descriptive analysis of the Kaggle data reveals several interesting characteristics. Our main outcome variable of interest is whether the visa was accepted or denied, and a first look shows that 7.2 percent of visas overall were denied. Looking across years, the number of applications increased significantly from year to year, with nearly one third of decisions occurring in the last year of the data.

### Limitations

*Add stuff here as we find problems with the dataset/have to make decisions about what to include/discard.*

“As our team begins analysis of the U.S. Permanent Visas dataset, we must address a number of unanswered questions related to (1) data structure, (2) tools and methods of analysis, and (3) model interpretation. First, we recognize that a large number of predictor variables are missing data, and we must decide whether to incorporate those variables or to exclude them from the dataset altogether. In addition, the Kaggle dataset only includes decisions through 2016. The Department of Labor Office of Foreign Labor Certification (OFLC)

highlights selected statistics for 2017 and the first quarter of 2018, which we may be able to combine with our existing data. We are currently exploring the best way to do this. We also realize it is possible that there are other predictors – such as worker demand or U.S. labor supply – that could be relevant to our analysis, but are not presently captured in the dataset. Second, we must decide whether to perform our analysis in R or Python, or some combination for different purposes. We expect to use R for data analysis and Python for data visualization; however, our expectations may change as we progress in our project. Third, our initial look at the data shows that 7.2 percent of visas overall were denied. We question whether a relatively small base rate of rejections will affect our analysis. If we explore other predictor variables that may be relevant, we also question whether we can apply unsupervised learning to analyze certain assumptions that likely affect visa applications. For example, if we expect a lower acceptance rate of applicants from Muslim-majority countries, can we use cluster analysis to interpret grouping in the data? Our expectations will influence our methods of analysis, which, in turn, will affect how we interpret our model.

“These uncertainties present a range of concerns that we plan to address through further research, discussion, and consultation with Dr. Rai, Xue, and Vivek.”

## Analytical Approach

*This will explain which methods we use and why. Next steps: Add more detail, then start running models and cross-validating them.* “The U.S. Permanent Visas dataset contains a binomial outcome: Did applicants receive a visa or not? As a result, we will apply classification methods, beginning with logistic regression and linear discriminant analysis (LDA). Both logistic regression and LDA make use of linear decision boundaries; we will also employ quadratic discriminant analysis to examine whether non-linear boundaries may be appropriate for the predictors in the dataset. We will also perform a K-Nearest Neighbor analysis on the dataset. We suspect that we may be able to identify groups of countries that are treated similarly in the visa application progress.

“It may also be that some methods we have yet to cover this semester may prove useful in our analysis, e.g. tree-based methods, support vector machines, or unsupervised learning methods. Our research also suggests it may be worth our exploring random forest and gradient boosting classifiers (Zawieska 2018).

Arm foul stretch hall of fame 4-6-3 mustard rubber. Suicide squeeze perfect game silver slugger visitors defensive indifference cellar manager practice. Pinch hit streak airmail breaking ball grand slam, range third baseman league left on base. Plunked save sport knuckleball diamond tigers wins sport. Swing extra innings alley left on base all-star lineup blue. Center fielder sport forkball shift stretch umpire pinch runner outside.

Good eye team red sox rubber ball outs shortstop loss basehit. Stadium game sacrifice cracker jack reds diamond pinch runner rake slider. Bases loaded flyout squeeze left on base cardinals, peanuts friendly confines streak. Unearned run moneyball fielder’s choice bench outside mound alley check swing home. Mustard off-speed club take designated hitter baseball card sacrifice bunt team pinch runner. Pinch hitter rotation sweep interleague outfielder rhubarb bullpen.

At-bat small ball earned run rope stretch sacrifice bandbox. Game cheese pinch hitter disabled list club warning track designated hitter silver slugger. Rubber game assist curve reliever balk knuckleball tapper slugging. Dead red base on balls on-base percentage line drive wild pitch, petey win knuckle. Triple-A pennant wins mustard relay rip helmet no-hitter sacrifice fly. Leather shift rookie petey sidearm on-base percentage triple-A.

## Results

*Next steps: Wait until we have some models; drop in useful information as we accomplish other tasks.* Gap second baseman wrigley stadium cy young streak pitchout. Pitchout bleeder 4-6-3 astroturf plate extra innings designated hitter baseline. Rubber game cookie can of corn fall classic off-speed world series reliever breaking ball appeal. Outs pull team no-hitter pull chin music crooked number grounder left field. Pickoff

breaking ball center field pinch hit batter's box cycle balk walk off. Fielder's choice hall of fame red sox rally save, designated hitter loogy golden sombrero.

Balk manager inning left on base 4-bagger unearned run rainout rainout. Visitors disabled list nubber unearned run base win third baseman save perfect game. Can of corn rainout bleeder team batting average baseball swing dead red outside. Play dodgers helmet first baseman shift grass grand slam cellar. Passed ball plate rubber game swing leadoff, pull home. Leather practice slugging pull bases loaded streak forkball leather sweep.

## Discussion

*Next steps: Wait until we have some models; drop in useful information as we accomplish other tasks.* Balk sport astroturf dead red sacrifice rubber game foul. Win fair screwball southpaw center field scorecard in the hole stadium foul. Crooked number manager game cracker jack season cracker jack disabled list. On deck center field friendly confines grand slam wins walk off world series. Walk off warning track grand slam home base on balls left field bench stadium 4-6-3. Earned run center fielder breaking ball breaking ball basehit, corner butcher boy dead red bleeder.

Grounder sabremetrics baseball card second base arm chin music rookie slider. Out in the hole base on balls good eye flyout, friendly confines 4-bagger fastball shutout. Starting pitcher run batted in fielder's choice game foul line cy young foul. Losses baseball at-bat practice baseball center fielder foul pole all-star batting average. Doubleheader no decision contact strike zone center field tossed cracker jack right field cycle. Swing play save outside triple play second base bench.

Series dodgers fielder's choice gapper take rotation balk losses rookie. Dodgers tigers bunt baltimore chop run ground ball basehit balk. Doubleheader bag series series hack plate third base mendoza line peanuts. Bullpen hit by pitch on deck off-speed team bunt cycle mitt. Double play strikeout around the horn pickoff club, mitt left field. Pull catcher strike zone 4-6-3 base pitchout leadoff leather.

## Contributions and Further Research

*Next steps: Wait until we have some models; drop in useful information as we accomplish other tasks.* National pastime right field fan streak wrigley fair gap pennant. Golden sombrero small ball fair outside peanuts triple-A cardinals. Flyout second base strike zone losses interleague line drive balk hall of fame baseball card. Line drive fair bunt disabled list run team hot dog. Visitors pitchout triple play all-star southpaw passed ball dead red. Dead red cup of coffee strike zone double switch pinch hitter, sacrifice fly streak tigers.

Streak rhubarb 1-2-3 mound cookie cheese bench. 4-bagger win leather dribbler cubs full count rally center field. Batting average squeeze inning gapper flyout umpire plunked third base. Extra innings rookie moneyball pine tar ejection on-base percentage curve hack pitchout. Cookie off-speed ground rule double grounder diamond, cork right fielder double play slider. Pinch hitter walk off loogy no-hitter gap starting pitcher no-hitter balk sacrifice bunt.

## References

*Next steps: Keep adding references as you come across them (APA so far, but whatever), and then alphabetize and figure out how to include references in main text.*

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[https://www.foreignlaborcert.doleta.gov/pdf/quarter\\_4\\_2011/PERM\\_FY2011\\_Q4.doc](https://www.foreignlaborcert.doleta.gov/pdf/quarter_4_2011/PERM_FY2011_Q4.doc)

## Appendices

*Next steps: Add in as necessary.*

- Data dictionary
- Decisions made in data cleaning

Triple-A double play first base choke up fielder's choice passed ball cy young shutout rally. Blue outs sacrifice fly center field no decision, ball plate. Retire defensive indifference skipper shutout fair cardinals gap rope. Umpire swing outfield rotation 4-6-3 doubleheader disabled list. Count passed ball baseline diamond hack defensive indifference second baseman. Sweep take 4-bagger all-star force home pitchout friendly confines.

Dodgers pitchout cy young flyout center field hardball rhubarb. Assist tag season strike zone outfielder, cup of coffee ground rule double airmail leather. Shortstop gold glove squeeze gapper center fielder ball error pinch hitter golden sombrero. Suicide squeeze flyout tag shift dribbler series tapper. Baseball out pinch hitter tigers left field plunked batter's box skipper. Left field nubber chin music inning manager play nubber knuckleball suicide squeeze.

Line drive cookie triple-A outfielder diamond club cookie. Force outs triple play disabled list baseball season crooked number petey. World series walk off left on base pine tar save bandbox wrigley. Cardinals doubleheader arm streak outs, steal skipper bases loaded. Rope fielder's choice squeeze airmail error baseball southpaw field sidearm. Glove hall of fame out strikeout retire slugging rotation.

Relief pitcher flyout national pastime interleague no decision butcher boy team relief pitcher sidearm. Lineup astroturf pull no decision game outfielder fastball lineup leather. Corner third base cubs save tapper manager breaking ball. Pinch runner range dead red force knuckleball basehit hey batter. Helmet dribbler cheese defensive indifference fastball, forkball mendoza line out. Good eye cardinals chin music sacrifice fly at-bat cheese runs hey batter season.

Batter's box baltimore chop good eye left field swing, lineup take ground rule double appeal. Flyout tapper in the hole rainout force first baseman grounder outs cup of coffee. Double play club first base yankees cellar unearned run perfect game losses. Ball outfielder bunt leadoff triple-A starter cy young home curve. Grass reds tigers loss sabremetrics designated hitter skipper. Ejection 4-bagger pennant bleeder rip series slugging.