**Details**

Here I estimate a series of models for high-risk fires, fire size, injuries and deaths.

Unlike in previous analyses, this analysis operates at the parcel level. Results will then be rolled up to the census tract level for FireCARES.

Predictors used in the model were organized into subgroups to simplify model selection for most models. The groups are summarized below.

**Risk Class**: Risk class is the type of property use the parcel fell into, and is one of: “Assembly,” “High Rise,” “Industrial,” “Institutional,” “Medical,” and “School.”

**Time**: Year, with 2014 being year zero, was included in the analysis to allow for risk to vary over time.

**High Rise**: These include the number of floors and a dummy for whether the parcel was residential.

**Base**: The base variables were population, number of males, and total number of housing units.

**Race**: includes a number of racial and ethnic categories.

**Age**: includes the age distribution of the population.

**House**: Includes a set of housing characteristics, including number of vacant houses, number of renters, number of households with more people than rooms, number of 1 and two unit residences (“single-family homes”), number of units that are part of a 10-unit or more block, number of units built before 1980, and number of mobile homes.

**Personal**: A list of personal and household characteristics: median household income, Social Vulnerability Index, number of married people, number of unemployed, number of those not in the labor force,and percent of adult smokers (determined at both the state and county level).

I included risk class in the set of predictors because I expected the risks presented by the different classes of properties to be different. Risk class was included in all models. The remaining groups where included in some models but not all.

***Data***

High risk was determined differently from the determination for low and medium risk. High risk was determined at the parcel level.

Parcels were selected from the CoreLogic data set based on the specific properties identified by Tyler from other data sets. Fires were identified based on their geocoded location. Any fire that overlapped the bounding box for a high-risk parcel, and was a structural fire (any NFIRS incident type beginning with ‘11’) was included as a high-risk fire and associated with the overlapping parcel. Note that the bounding box is guaranteed to be at least as large as the parcel, and in most cases will be bigger.

There are several potential problems with the incident selection approach. First it seems likely that some high-risk incidents are not included due to poor quality geocoding. Second, it seems likely that some non-high-risk incidents are included, both due to geocoding issues and due to the fact that bounding boxes are bigger than the actual parcels. Since high risk parcels are a small percentage of the total number of parcels in the data set, the first effect seems likely to have a bigger effect than the latter. Third, there are likely cases where the same incident is associated with more than one high-risk parcel due to the fact that bounding boxes are (in some cases) larger than the parcels themselves.

Since the approach used to identify high risk parcels is different from that used to identify low and medium risk parcels, the possibility exists of parcels being identified as both as high and medium or low risk, and of parcels that end up unclassified. Table 1 lists the number of parcels in the CoreLogic data set by both their CoreLogic categorization and by their “Tyler Risk” categorization. Italicized groups are either double-counted or excluded. While this has little impact on the current analysis, it will matter when the time comes to classify parcels for the FireCARES web site.

Table 1: Number of CoreLogic parcels by risk level

|  |  |  |
| --- | --- | --- |
| **CoreLogic Land Use** | **Tyler Risk** | |
| **'High'** | **Low / Med** |
| High | 66,871 | *721,506* |
| Medium | *228,804* | 13,273,678 |
| Low | *24,452* | 94,785,759 |
| (blank) | 658 | *139,132* |

As with the other classes of fires, geocoding is incomplete, and varies by department and year. This model adjusts for geocoding percentage at the department × year level, by including the geocoding percentage of all reported incidents (by department and year) as an offset to the model.

I used the data from 2007 to 2013 to estimate the model. The same filters used are summarized here. See the low-risk fires report for details.

*base*

I excluded any parcel where the tract in was in had any of the following characteristics:

* SVI < 0
* No reported median income
* No reported department size
* No reported County smoking data

*small.x*

All models excluded department × years where the department reported responding to fewer than 25 *incidents* that year. I also filtered out “outlier” years. “Outlier” years were defined as those years which fell at least 2 standard deviations below the mean number of incidents for the department. A specific definition is included in Appendix II of the low-risk report. Note that the “two standard deviations” standard is based on at most 7 years per department of data reported as part of the study.

*random\_subset*

One third of the parcels are set aside to serve as a test set, while the remaining parcels are used as the training set. The partition for test versus training sets is the same as that used for the low risk analysis.

***Department Size × Region***

As before, I excluded all departments serving fewer than 10,000 people (sizes 0 – 2). All departments nationwide serving 1 million or more people were analyzed together. For some models (more details below) departments in the Northeast in size range 8 were combined with those in the size range 7.

***Models***

Most models were estimated using the techniques of generalized linear models (glm), and had the following basic form:

|  |  |  |
| --- | --- | --- |
|  |  | (1) |

Where *yit* is the dependent variable being analyzed for the *i*th parcel in year *t*, *g* is a linking function used in the glm analysis, *ait* is a *known* offset value for the model, *xit* are the predictors used for that observation, *βt* is the change per year, *β* are the parameter estimates.

Unlike the low- and medium-risk models, I did not include a department effect. I made this choice mainly to keep the model tractable.

A LASSO model was run for all the dependent variables. The offset term described below was included as part of the LASSO analysis, and all the variables listed above were included. A large number of LASSO models were run, and compared using cross-validation over the training set. Two LASSO models were selected for evaluation against the test set: the model with the cross-validation minimum error (“min”), and the model with the largest cross-validated error within 1 standard error of the minimum (“1se”).

I also grew random forest models for all the dependent variables. All random forests consisted of 500 trees and were run on all the variables listed above. Neither LASSO nor random forest models included the department dummies to keep the models from being too large.

It is assumed that the number of fires, injuries or deaths for a parcel follow a (overdispersed) Poisson process. An offset term is used to reflect the proportion of incidents that were geolocated by department. That should convert these estimates, based on geolocated fires, injuries or deaths, into a model of total fires, injuries or deaths.

For fire size, it is assumed that they follow a binomial model. No offset was used for the fire size models because the number of relevant fires was already included as part of the model.

A large number of different models were run. They fall into two main classes. In the first group, I effectively estimated separate models for each region × department size group of departments. This is the same as I did before. In the second group, I just included dummy variables representing department size and region. This tested the effectiveness of a more parsimonious model.

The setup and functions used in computing and analyzing the models are described in Appendix II.

***Results***

All models are estimated against the training set. Then the estimated model is used to predict number of fires (or percent of fires for fire size, or injuries or deaths, depending on the model) for each parcel in the test set. Then for each model the Root Mean Square Error (RMSE) of the predicted value is calculated for the test set. All “Dummies” models, and the LASSO and random forest models also include dummies for department size and region, in addition to the variables listed.

For comparison, I include two naïve models that estimated number of fires for the test set. The first is a constant model. It assumes that all parcels have the same (average) expected value per year. The second is a pure risk-class model. It assumes that all tracts in the same risk-class have the same expected value per year.

In all cases below, I effectively restricted the test set to departments serving 100,000 people or more. This is consistent with the test set used in the low risk models.

Results are reported in Table 2 through Table 6, below.

Overfitting is a noticeable problem for deaths and injuries.

The random forest model is the best for everything except injuries. For injuries the best model is likely the model labeled “hr.0101011” for the “separate” class of models. However, there are many models that are very similar to that model and are likely indistinguishable from it.

Table 2: Mean Square Errors of the Fire models tested.

|  |  | **Mean Fires** | **RMSE** | |
| --- | --- | --- | --- | --- |
| **Model Run** | **Predictors** | **Separate** | **Dummies** |
| constant |  | 0.0996 | 0.6967 | |
| rsk.clss | risk class | 0.0996 | 0.6964 | |
| lasso.min | risk class, time, high.rise, base, race, age, house, personal | 0.0996 | 0.8986 | |
| lasso.1se | risk class, time, high.rise, base, race, age, house, personal | 0.0996 | 0.9370 | |
| rForest | risk class, time, high.rise, base, race, age, house, personal | 0.0996 | **0.6190** | |
| hr.0000000 | risk class | 0.0996 | 0.6904 | 0.6920 |
| hr.0000001 | risk class, personal | 0.0996 | 0.6841 | 0.6913 |
| hr.0000010 | risk class, house | 0.0996 | 0.6893 | 0.6840 |
| hr.0000011 | risk class, house, personal | 0.0996 | 0.6821 | 0.6708 |
| hr.0000100 | risk class, age | 0.0996 | 0.6883 | 0.7519 |
| hr.0000101 | risk class, age, personal | 0.0996 | 0.6822 | 0.7236 |
| hr.0000110 | risk class, age, house | 0.0996 | 0.6858 | 0.6961 |
| hr.0000111 | risk class, age, house, personal | 0.0996 | 0.6794 | 0.6785 |
| hr.0001000 | risk class, race | 0.0996 | 0.6892 | 0.7801 |
| hr.0001001 | risk class, race, personal | 0.0996 | 0.6868 | 0.6862 |
| hr.0001010 | risk class, race, house | 0.0996 | 0.6879 | 0.7317 |
| hr.0001011 | risk class, race, house, personal | 0.0996 | 0.6855 | 0.7193 |
| hr.0001100 | risk class, race, age | 0.0996 | 0.6862 | 0.6909 |
| hr.0001101 | risk class, race, age, personal | 0.0996 | 0.6830 | 0.6753 |
| hr.0001110 | risk class, race, age, house | 0.0996 | 0.6843 | 0.7129 |
| hr.0001111 | risk class, race, age, house, personal | 0.0996 | 0.6821 | 0.6850 |
| hr.0010000 | risk class, base | 0.0996 | 0.6883 | 0.7014 |
| hr.0010001 | risk class, base, personal | 0.0996 | 0.6834 | 0.6774 |
| hr.0010010 | risk class, base, house | 0.0996 | 0.6885 | 0.6908 |
| hr.0010011 | risk class, base, house, personal | 0.0996 | 0.6824 | 0.6684 |
| hr.0010100 | risk class, base, age | 0.0996 | 0.6880 | 0.7098 |
| hr.0010101 | risk class, base, age, personal | 0.0996 | 0.6816 | 0.6802 |
| hr.0010110 | risk class, base, age, house | 0.0996 | 0.6887 | 0.6825 |
| hr.0010111 | risk class, base, age, house, personal | 0.0996 | 0.6788 | 0.6684 |
| hr.0011000 | risk class, base, race | 0.0996 | 0.6883 | 0.6999 |
| hr.0011001 | risk class, base, race, personal | 0.0996 | 0.6869 | 0.6779 |
| hr.0011010 | risk class, base, race, house | 0.0996 | 0.6918 | 0.9260 |
| hr.0011011 | risk class, base, race, house, personal | 0.0996 | 0.6861 | 0.7410 |
| hr.0011100 | risk class, base, race, age | 0.0996 | 0.6869 | 0.7126 |
| hr.0011101 | risk class, base, race, age, personal | 0.0996 | 0.6849 | 0.6799 |
| hr.0011110 | risk class, base, race, age, house | 0.0996 | 0.6863 | 0.8090 |
| hr.0011111 | risk class, base, race, age, house, personal | 0.0996 | 0.6825 | 0.7380 |
| hr.0100000 | risk class, high.rise | 0.0996 | 0.6901 | 0.6906 |
| hr.0100001 | risk class, high.rise, personal | 0.0996 | 0.6825 | 0.6870 |
| hr.0100010 | risk class, high.rise, house | 0.0996 | 0.6891 | 0.6826 |
| hr.0100011 | risk class, high.rise, house, personal | 0.0996 | 0.6798 | 0.6655 |
| hr.0100100 | risk class, high.rise, age | 0.0996 | 0.6880 | 0.7655 |
| hr.0100101 | risk class, high.rise, age, personal | 0.0996 | 0.6805 | 0.7165 |
| hr.0100110 | risk class, high.rise, age, house | 0.0996 | 0.6858 | 0.6963 |
| hr.0100111 | risk class, high.rise, age, house, personal | 0.0996 | 0.6771 | 0.6804 |
| hr.0101000 | risk class, high.rise, race | 0.0996 | 0.6883 | 0.7633 |
| hr.0101001 | risk class, high.rise, race, personal | 0.0996 | 0.6846 | 0.6769 |
| hr.0101010 | risk class, high.rise, race, house | 0.0996 | 0.6858 | 0.7057 |
| hr.0101011 | risk class, high.rise, race, house, personal | 0.0996 | 0.6824 | 0.6881 |
| hr.0101100 | risk class, high.rise, race, age | 0.0996 | 0.6854 | 0.6880 |
| hr.0101101 | risk class, high.rise, race, age, personal | 0.0996 | 0.6811 | 0.6686 |
| hr.0101110 | risk class, high.rise, race, age, house | 0.0996 | 0.6830 | 0.6887 |
| hr.0101111 | risk class, high.rise, race, age, house, personal | 0.0996 | 0.6796 | 0.6707 |
| hr.0110000 | risk class, high.rise, base | 0.0996 | 0.6880 | 0.7057 |
| hr.0110001 | risk class, high.rise, base, personal | 0.0996 | 0.6819 | 0.6730 |
| hr.0110010 | risk class, high.rise, base, house | 0.0996 | 0.6885 | 0.6907 |
| hr.0110011 | risk class, high.rise, base, house, personal | 0.0996 | 0.6798 | 0.6627 |
| hr.0110100 | risk class, high.rise, base, age | 0.0996 | 0.6875 | 0.7249 |
| hr.0110101 | risk class, high.rise, base, age, personal | 0.0996 | 0.6799 | 0.6762 |
| hr.0110110 | risk class, high.rise, base, age, house | 0.0996 | 0.6894 | 0.6847 |
| hr.0110111 | risk class, high.rise, base, age, house, personal | 0.0996 | 0.6768 | 0.6698 |
| hr.0111000 | risk class, high.rise, base, race | 0.0996 | 0.6870 | 0.6904 |
| hr.0111001 | risk class, high.rise, base, race, personal | 0.0996 | 0.6848 | 0.6676 |
| hr.0111010 | risk class, high.rise, base, race, house | 0.0996 | 0.6897 | 0.8122 |
| hr.0111011 | risk class, high.rise, base, race, house, personal | 0.0996 | 0.6829 | 0.6943 |
| hr.0111100 | risk class, high.rise, base, race, age | 0.0996 | 0.6861 | 0.7029 |
| hr.0111101 | risk class, high.rise, base, race, age, personal | 0.0996 | 0.6832 | 0.6697 |
| hr.0111110 | risk class, high.rise, base, race, age, house | 0.0996 | 0.6854 | 0.7556 |
| hr.0111111 | risk class, high.rise, base, race, age, house, personal | 0.0996 | 0.6802 | 0.6960 |
| hr.1000000 | risk class, time | 0.0996 | 0.6905 | 0.6911 |
| hr.1000001 | risk class, time, personal | 0.0996 | 0.6842 | 0.6842 |
| hr.1000010 | risk class, time, house | 0.0996 | 0.6895 | 0.6821 |
| hr.1000011 | risk class, time, house, personal | 0.0996 | 0.6820 | 0.6659 |
| hr.1000100 | risk class, time, age | 0.0996 | 0.6886 | 0.7120 |
| hr.1000101 | risk class, time, age, personal | 0.0996 | 0.6823 | 0.6948 |
| hr.1000110 | risk class, time, age, house | 0.0996 | 0.6860 | 0.6823 |
| hr.1000111 | risk class, time, age, house, personal | 0.0996 | 0.6796 | 0.6686 |
| hr.1001000 | risk class, time, race | 0.0996 | 0.6890 | 0.7722 |
| hr.1001001 | risk class, time, race, personal | 0.0996 | 0.6873 | 0.6828 |
| hr.1001010 | risk class, time, race, house | 0.0996 | 0.6874 | 0.7322 |
| hr.1001011 | risk class, time, race, house, personal | 0.0996 | 0.6851 | 0.7170 |
| hr.1001100 | risk class, time, race, age | 0.0996 | 0.6873 | 0.6870 |
| hr.1001101 | risk class, time, race, age, personal | 0.0996 | 0.6838 | 0.6707 |
| hr.1001110 | risk class, time, race, age, house | 0.0996 | 0.6850 | 0.7130 |
| hr.1001111 | risk class, time, race, age, house, personal | 0.0996 | 0.6823 | 0.6828 |
| hr.1010000 | risk class, time, base | 0.0996 | 0.6884 | 0.7049 |
| hr.1010001 | risk class, time, base, personal | 0.0996 | 0.6836 | 0.6748 |
| hr.1010010 | risk class, time, base, house | 0.0996 | 0.6893 | 0.6895 |
| hr.1010011 | risk class, time, base, house, personal | 0.0996 | 0.6823 | 0.6666 |
| hr.1010100 | risk class, time, base, age | 0.0996 | 0.6882 | 0.6998 |
| hr.1010101 | risk class, time, base, age, personal | 0.0996 | 0.6819 | 0.6736 |
| hr.1010110 | risk class, time, base, age, house | 0.0996 | 0.6903 | 0.6821 |
| hr.1010111 | risk class, time, base, age, house, personal | 0.0996 | 0.6794 | 0.6670 |
| hr.1011000 | risk class, time, base, race | 0.0996 | 0.6889 | 0.6962 |
| hr.1011001 | risk class, time, base, race, personal | 0.0996 | 0.6873 | 0.6758 |
| hr.1011010 | risk class, time, base, race, house | 0.0996 | 0.6915 | 0.9203 |
| hr.1011011 | risk class, time, base, race, house, personal | 0.0996 | 0.6857 | 0.7379 |
| hr.1011100 | risk class, time, base, race, age | 0.0996 | 0.6884 | 0.7089 |
| hr.1011101 | risk class, time, base, race, age, personal | 0.0996 | 0.6863 | 0.6773 |
| hr.1011110 | risk class, time, base, race, age, house | 0.0996 | 0.6880 | 0.8086 |
| hr.1011111 | risk class, time, base, race, age, house, personal | 0.0996 | 0.6829 | 0.7343 |
| hr.1100000 | risk class, time, high.rise | 0.0996 | 0.6902 | 0.6897 |
| hr.1100001 | risk class, time, high.rise, personal | 0.0996 | 0.6827 | 0.6796 |
| hr.1100010 | risk class, time, high.rise, house | 0.0996 | 0.6893 | 0.6805 |
| hr.1100011 | risk class, time, high.rise, house, personal | 0.0996 | 0.6798 | 0.6602 |
| hr.1100100 | risk class, time, high.rise, age | 0.0996 | 0.6883 | 0.7267 |
| hr.1100101 | risk class, time, high.rise, age, personal | 0.0996 | 0.6806 | 0.6893 |
| hr.1100110 | risk class, time, high.rise, age, house | 0.0996 | 0.6860 | 0.6825 |
| hr.1100111 | risk class, time, high.rise, age, house, personal | 0.0996 | 0.6773 | 0.6695 |
| hr.1101000 | risk class, time, high.rise, race | 0.0996 | 0.6881 | 0.7551 |
| hr.1101001 | risk class, time, high.rise, race, personal | 0.0996 | 0.6850 | 0.6735 |
| hr.1101010 | risk class, time, high.rise, race, house | 0.0996 | 0.6854 | 0.7042 |
| hr.1101011 | risk class, time, high.rise, race, house, personal | 0.0996 | 0.6821 | 0.6860 |
| hr.1101100 | risk class, time, high.rise, race, age | 0.0996 | 0.6864 | 0.6866 |
| hr.1101101 | risk class, time, high.rise, race, age, personal | 0.0996 | 0.6819 | 0.6642 |
| hr.1101110 | risk class, time, high.rise, race, age, house | 0.0996 | 0.6837 | 0.6881 |
| hr.1101111 | risk class, time, high.rise, race, age, house, personal | 0.0996 | 0.6799 | 0.6685 |
| hr.1110000 | risk class, time, high.rise, base | 0.0996 | 0.6881 | 0.7091 |
| hr.1110001 | risk class, time, high.rise, base, personal | 0.0996 | 0.6821 | 0.6699 |
| hr.1110010 | risk class, time, high.rise, base, house | 0.0996 | 0.6895 | 0.6909 |
| hr.1110011 | risk class, time, high.rise, base, house, personal | 0.0996 | 0.6799 | 0.6606 |
| hr.1110100 | risk class, time, high.rise, base, age | 0.0996 | 0.6877 | 0.7191 |
| hr.1110101 | risk class, time, high.rise, base, age, personal | 0.0996 | 0.6802 | 0.6707 |
| hr.1110110 | risk class, time, high.rise, base, age, house | 0.0996 | 0.6911 | 0.6862 |
| hr.1110111 | risk class, time, high.rise, base, age, house, personal | 0.0996 | 0.6774 | 0.6684 |
| hr.1111000 | risk class, time, high.rise, base, race | 0.0996 | 0.6876 | 0.6863 |
| hr.1111001 | risk class, time, high.rise, base, race, personal | 0.0996 | 0.6852 | 0.6654 |
| hr.1111010 | risk class, time, high.rise, base, race, house | 0.0996 | 0.6898 | 0.8079 |
| hr.1111011 | risk class, time, high.rise, base, race, house, personal | 0.0996 | 0.6826 | 0.6911 |
| hr.1111100 | risk class, time, high.rise, base, race, age | 0.0996 | 0.6875 | 0.7002 |
| hr.1111101 | risk class, time, high.rise, base, race, age, personal | 0.0996 | 0.6845 | 0.6672 |
| hr.1111110 | risk class, time, high.rise, base, race, age, house | 0.0996 | 0.6871 | 0.7549 |
| hr.1111111 | risk class, time, high.rise, base, race, age, house, personal | 0.0996 | 0.6808 | 0.6937 |

Table 3: Mean Square Errors of the Size-2 models tested.

|  |  | **Pct Size 2 Fires** | **RMSE** | |
| --- | --- | --- | --- | --- |
| **Model Run** | **Predictors** | **Dummies** | **Separate** |
| constant |  | 0.0568 | 0.2148 | |
| rsk.clss | risk class | 0.0568 | 0.2105 | |
| lasso.min | risk class, time, high.rise, base, race, age, house, personal | 0.0568 | 0.9259 | |
| lasso.1se | risk class, time, high.rise, base, race, age, house, personal | 0.0568 | 0.9267 | |
| rForest | risk class, time, high.rise, base, race, age, house, personal | 0.0568 | **0.1597** | |
| hr.0000000 | risk class | 0.0568 | 0.2091 | 0.2043 |
| hr.0000001 | risk class, personal | 0.0568 | 0.2081 | 0.1956 |
| hr.0000010 | risk class, house | 0.0568 | 0.2068 | 0.1965 |
| hr.0000011 | risk class, house, personal | 0.0568 | 0.2054 | 0.1894 |
| hr.0000100 | risk class, age | 0.0568 | 0.2078 | 0.1945 |
| hr.0000101 | risk class, age, personal | 0.0568 | 0.2070 | 0.1874 |
| hr.0000110 | risk class, age, house | 0.0568 | 0.2057 | 0.1908 |
| hr.0000111 | risk class, age, house, personal | 0.0568 | 0.2041 | 0.1845 |
| hr.0001000 | risk class, race | 0.0568 | 0.2091 | 0.2033 |
| hr.0001001 | risk class, race, personal | 0.0568 | 0.2079 | 0.1938 |
| hr.0001010 | risk class, race, house | 0.0568 | 0.2067 | 0.1951 |
| hr.0001011 | risk class, race, house, personal | 0.0568 | 0.2050 | 0.1876 |
| hr.0001100 | risk class, race, age | 0.0568 | 0.2080 | 0.1937 |
| hr.0001101 | risk class, race, age, personal | 0.0568 | 0.2068 | 0.1868 |
| hr.0001110 | risk class, race, age, house | 0.0568 | 0.2058 | 0.1899 |
| hr.0001111 | risk class, race, age, house, personal | 0.0568 | 0.2040 | 0.1844 |
| hr.0010000 | risk class, base | 0.0568 | 0.2088 | 0.2004 |
| hr.0010001 | risk class, base, personal | 0.0568 | 0.2075 | 0.1942 |
| hr.0010010 | risk class, base, house | 0.0568 | 0.2055 | 0.1917 |
| hr.0010011 | risk class, base, house, personal | 0.0568 | 0.2047 | 0.1871 |
| hr.0010100 | risk class, base, age | 0.0568 | 0.2064 | 0.1923 |
| hr.0010101 | risk class, base, age, personal | 0.0568 | 0.2055 | 0.1871 |
| hr.0010110 | risk class, base, age, house | 0.0568 | 0.2048 | 0.1892 |
| hr.0010111 | risk class, base, age, house, personal | 0.0568 | 0.2034 | 0.1845 |
| hr.0011000 | risk class, base, race | 0.0568 | 0.2087 | 0.1998 |
| hr.0011001 | risk class, base, race, personal | 0.0568 | 0.2074 | 0.1926 |
| hr.0011010 | risk class, base, race, house | 0.0568 | 0.2056 | 0.1911 |
| hr.0011011 | risk class, base, race, house, personal | 0.0568 | 0.2047 | 0.1862 |
| hr.0011100 | risk class, base, race, age | 0.0568 | 0.2066 | 0.1912 |
| hr.0011101 | risk class, base, race, age, personal | 0.0568 | 0.2056 | 0.1865 |
| hr.0011110 | risk class, base, race, age, house | 0.0568 | 0.2048 | 0.1883 |
| hr.0011111 | risk class, base, race, age, house, personal | 0.0568 | 0.2035 | 0.1844 |
| hr.0100000 | risk class, high.rise | 0.0568 | 0.2081 | 0.2039 |
| hr.0100001 | risk class, high.rise, personal | 0.0568 | 0.2075 | 0.1949 |
| hr.0100010 | risk class, high.rise, house | 0.0568 | 0.2069 | 0.1964 |
| hr.0100011 | risk class, high.rise, house, personal | 0.0568 | 0.2056 | 0.1896 |
| hr.0100100 | risk class, high.rise, age | 0.0568 | 0.2072 | 0.1931 |
| hr.0100101 | risk class, high.rise, age, personal | 0.0568 | 0.2065 | 0.1869 |
| hr.0100110 | risk class, high.rise, age, house | 0.0568 | 0.2060 | 0.1901 |
| hr.0100111 | risk class, high.rise, age, house, personal | 0.0568 | 0.2044 | 0.1842 |
| hr.0101000 | risk class, high.rise, race | 0.0568 | 0.2081 | 0.2030 |
| hr.0101001 | risk class, high.rise, race, personal | 0.0568 | 0.2073 | 0.1936 |
| hr.0101010 | risk class, high.rise, race, house | 0.0568 | 0.2068 | 0.1945 |
| hr.0101011 | risk class, high.rise, race, house, personal | 0.0568 | 0.2053 | 0.1880 |
| hr.0101100 | risk class, high.rise, race, age | 0.0568 | 0.2074 | 0.1922 |
| hr.0101101 | risk class, high.rise, race, age, personal | 0.0568 | 0.2065 | 0.1862 |
| hr.0101110 | risk class, high.rise, race, age, house | 0.0568 | 0.2061 | 0.1891 |
| hr.0101111 | risk class, high.rise, race, age, house, personal | 0.0568 | 0.2045 | 0.1841 |
| hr.0110000 | risk class, high.rise, base | 0.0568 | 0.2081 | 0.1997 |
| hr.0110001 | risk class, high.rise, base, personal | 0.0568 | 0.2070 | 0.1930 |
| hr.0110010 | risk class, high.rise, base, house | 0.0568 | 0.2057 | 0.1916 |
| hr.0110011 | risk class, high.rise, base, house, personal | 0.0568 | 0.2050 | 0.1866 |
| hr.0110100 | risk class, high.rise, base, age | 0.0568 | 0.2061 | 0.1910 |
| hr.0110101 | risk class, high.rise, base, age, personal | 0.0568 | 0.2053 | 0.1866 |
| hr.0110110 | risk class, high.rise, base, age, house | 0.0568 | 0.2051 | 0.1883 |
| hr.0110111 | risk class, high.rise, base, age, house, personal | 0.0568 | 0.2038 | 0.1841 |
| hr.0111000 | risk class, high.rise, base, race | 0.0568 | 0.2080 | 0.1988 |
| hr.0111001 | risk class, high.rise, base, race, personal | 0.0568 | 0.2070 | 0.1912 |
| hr.0111010 | risk class, high.rise, base, race, house | 0.0568 | 0.2058 | 0.1904 |
| hr.0111011 | risk class, high.rise, base, race, house, personal | 0.0568 | 0.2050 | 0.1855 |
| hr.0111100 | risk class, high.rise, base, race, age | 0.0568 | 0.2063 | 0.1899 |
| hr.0111101 | risk class, high.rise, base, race, age, personal | 0.0568 | 0.2054 | 0.1859 |
| hr.0111110 | risk class, high.rise, base, race, age, house | 0.0568 | 0.2051 | 0.1871 |
| hr.0111111 | risk class, high.rise, base, race, age, house, personal | 0.0568 | 0.2039 | 0.1840 |
| hr.1000000 | risk class, time | 0.0568 | 0.2087 | 0.2021 |
| hr.1000001 | risk class, time, personal | 0.0568 | 0.2079 | 0.1922 |
| hr.1000010 | risk class, time, house | 0.0568 | 0.2063 | 0.1950 |
| hr.1000011 | risk class, time, house, personal | 0.0568 | 0.2049 | 0.1880 |
| hr.1000100 | risk class, time, age | 0.0568 | 0.2075 | 0.1938 |
| hr.1000101 | risk class, time, age, personal | 0.0568 | 0.2067 | 0.1869 |
| hr.1000110 | risk class, time, age, house | 0.0568 | 0.2053 | 0.1894 |
| hr.1000111 | risk class, time, age, house, personal | 0.0568 | 0.2035 | 0.1837 |
| hr.1001000 | risk class, time, race | 0.0568 | 0.2087 | 0.2013 |
| hr.1001001 | risk class, time, race, personal | 0.0568 | 0.2076 | 0.1903 |
| hr.1001010 | risk class, time, race, house | 0.0568 | 0.2062 | 0.1940 |
| hr.1001011 | risk class, time, race, house, personal | 0.0568 | 0.2046 | 0.1864 |
| hr.1001100 | risk class, time, race, age | 0.0568 | 0.2078 | 0.1932 |
| hr.1001101 | risk class, time, race, age, personal | 0.0568 | 0.2066 | 0.1863 |
| hr.1001110 | risk class, time, race, age, house | 0.0568 | 0.2054 | 0.1884 |
| hr.1001111 | risk class, time, race, age, house, personal | 0.0568 | 0.2035 | 0.1837 |
| hr.1010000 | risk class, time, base | 0.0568 | 0.2083 | 0.1981 |
| hr.1010001 | risk class, time, base, personal | 0.0568 | 0.2071 | 0.1908 |
| hr.1010010 | risk class, time, base, house | 0.0568 | 0.2051 | 0.1904 |
| hr.1010011 | risk class, time, base, house, personal | 0.0568 | 0.2043 | 0.1860 |
| hr.1010100 | risk class, time, base, age | 0.0568 | 0.2061 | 0.1914 |
| hr.1010101 | risk class, time, base, age, personal | 0.0568 | 0.2051 | 0.1867 |
| hr.1010110 | risk class, time, base, age, house | 0.0568 | 0.2044 | 0.1879 |
| hr.1010111 | risk class, time, base, age, house, personal | 0.0568 | 0.2029 | 0.1836 |
| hr.1011000 | risk class, time, base, race | 0.0568 | 0.2082 | 0.1976 |
| hr.1011001 | risk class, time, base, race, personal | 0.0568 | 0.2070 | 0.1891 |
| hr.1011010 | risk class, time, base, race, house | 0.0568 | 0.2053 | 0.1898 |
| hr.1011011 | risk class, time, base, race, house, personal | 0.0568 | 0.2043 | 0.1847 |
| hr.1011100 | risk class, time, base, race, age | 0.0568 | 0.2063 | 0.1905 |
| hr.1011101 | risk class, time, base, race, age, personal | 0.0568 | 0.2052 | 0.1861 |
| hr.1011110 | risk class, time, base, race, age, house | 0.0568 | 0.2045 | 0.1871 |
| hr.1011111 | risk class, time, base, race, age, house, personal | 0.0568 | 0.2029 | 0.1837 |
| hr.1100000 | risk class, time, high.rise | 0.0568 | 0.2076 | 0.2019 |
| hr.1100001 | risk class, time, high.rise, personal | 0.0568 | 0.2071 | 0.1918 |
| hr.1100010 | risk class, time, high.rise, house | 0.0568 | 0.2064 | 0.1944 |
| hr.1100011 | risk class, time, high.rise, house, personal | 0.0568 | 0.2052 | 0.1883 |
| hr.1100100 | risk class, time, high.rise, age | 0.0568 | 0.2069 | 0.1922 |
| hr.1100101 | risk class, time, high.rise, age, personal | 0.0568 | 0.2063 | 0.1866 |
| hr.1100110 | risk class, time, high.rise, age, house | 0.0568 | 0.2055 | 0.1888 |
| hr.1100111 | risk class, time, high.rise, age, house, personal | 0.0568 | 0.2039 | 0.1835 |
| hr.1101000 | risk class, time, high.rise, race | 0.0568 | 0.2076 | 0.2010 |
| hr.1101001 | risk class, time, high.rise, race, personal | 0.0568 | 0.2069 | 0.1907 |
| hr.1101010 | risk class, time, high.rise, race, house | 0.0568 | 0.2063 | 0.1931 |
| hr.1101011 | risk class, time, high.rise, race, house, personal | 0.0568 | 0.2048 | 0.1867 |
| hr.1101100 | risk class, time, high.rise, race, age | 0.0568 | 0.2072 | 0.1914 |
| hr.1101101 | risk class, time, high.rise, race, age, personal | 0.0568 | 0.2062 | 0.1860 |
| hr.1101110 | risk class, time, high.rise, race, age, house | 0.0568 | 0.2056 | 0.1880 |
| hr.1101111 | risk class, time, high.rise, race, age, house, personal | 0.0568 | 0.2040 | 0.1836 |
| hr.1110000 | risk class, time, high.rise, base | 0.0568 | 0.2075 | 0.1968 |
| hr.1110001 | risk class, time, high.rise, base, personal | 0.0568 | 0.2066 | 0.1904 |
| hr.1110010 | risk class, time, high.rise, base, house | 0.0568 | 0.2053 | 0.1899 |
| hr.1110011 | risk class, time, high.rise, base, house, personal | 0.0568 | 0.2046 | 0.1857 |
| hr.1110100 | risk class, time, high.rise, base, age | 0.0568 | 0.2058 | 0.1903 |
| hr.1110101 | risk class, time, high.rise, base, age, personal | 0.0568 | 0.2049 | 0.1862 |
| hr.1110110 | risk class, time, high.rise, base, age, house | 0.0568 | 0.2047 | 0.1872 |
| hr.1110111 | risk class, time, high.rise, base, age, house, personal | 0.0568 | 0.2033 | 0.1833 |
| hr.1111000 | risk class, time, high.rise, base, race | 0.0568 | 0.2075 | 0.1962 |
| hr.1111001 | risk class, time, high.rise, base, race, personal | 0.0568 | 0.2066 | 0.1885 |
| hr.1111010 | risk class, time, high.rise, base, race, house | 0.0568 | 0.2055 | 0.1889 |
| hr.1111011 | risk class, time, high.rise, base, race, house, personal | 0.0568 | 0.2046 | 0.1843 |
| hr.1111100 | risk class, time, high.rise, base, race, age | 0.0568 | 0.2060 | 0.1894 |
| hr.1111101 | risk class, time, high.rise, base, race, age, personal | 0.0568 | 0.2051 | 0.1857 |
| hr.1111110 | risk class, time, high.rise, base, race, age, house | 0.0568 | 0.2047 | 0.1864 |
| hr.1111111 | risk class, time, high.rise, base, race, age, house, personal | 0.0568 | 0.2033 | 0.1833 |

Table 4: Mean Square Errors of the Size-3 models tested.

|  |  | **Pct Size 3 Fires** | **RMSE** | |
| --- | --- | --- | --- | --- |
| **Model Run** | **Predictors** | **Dummies** | **Separate** |
| constant |  | 0.0892 | 0.2774 | |
| rsk.clss | risk class | 0.0892 | 0.2689 | |
| lasso.min | risk class, time, high.rise, base, race, age, house, personal | 0.0892 | 0.8957 | |
| lasso.1se | risk class, time, high.rise, base, race, age, house, personal | 0.0892 | 0.8782 | |
| rForest | risk class, time, high.rise, base, race, age, house, personal | 0.0892 | **0.1948** | |
| hr.0000000 | risk class | 0.0892 | 0.2684 | 0.2702 |
| hr.0000001 | risk class, personal | 0.0892 | 0.2654 | 0.2391 |
| hr.0000010 | risk class, house | 0.0892 | 0.2617 | 0.2425 |
| hr.0000011 | risk class, house, personal | 0.0892 | 0.2583 | 0.2543 |
| hr.0000100 | risk class, age | 0.0892 | 0.2580 | 0.2334 |
| hr.0000101 | risk class, age, personal | 0.0892 | 0.2536 | 0.2484 |
| hr.0000110 | risk class, age, house | 0.0892 | 0.2509 | 0.2558 |
| hr.0000111 | risk class, age, house, personal | 0.0892 | 0.2475 | 0.2552 |
| hr.0001000 | risk class, race | 0.0892 | 0.2639 | 0.2336 |
| hr.0001001 | risk class, race, personal | 0.0892 | 0.2607 | 0.2302 |
| hr.0001010 | risk class, race, house | 0.0892 | 0.2583 | 0.2466 |
| hr.0001011 | risk class, race, house, personal | 0.0892 | 0.2553 | 0.2484 |
| hr.0001100 | risk class, race, age | 0.0892 | 0.2548 | 0.2463 |
| hr.0001101 | risk class, race, age, personal | 0.0892 | 0.2512 | 0.2560 |
| hr.0001110 | risk class, race, age, house | 0.0892 | 0.2478 | 0.2685 |
| hr.0001111 | risk class, race, age, house, personal | 0.0892 | 0.2454 | 0.2845 |
| hr.0010000 | risk class, base | 0.0892 | 0.2685 | 0.2633 |
| hr.0010001 | risk class, base, personal | 0.0892 | 0.2654 | 0.2348 |
| hr.0010010 | risk class, base, house | 0.0892 | 0.2574 | 0.2477 |
| hr.0010011 | risk class, base, house, personal | 0.0892 | 0.2506 | 0.2471 |
| hr.0010100 | risk class, base, age | 0.0892 | 0.2571 | 0.2414 |
| hr.0010101 | risk class, base, age, personal | 0.0892 | 0.2523 | 0.2496 |
| hr.0010110 | risk class, base, age, house | 0.0892 | 0.2451 | 0.2635 |
| hr.0010111 | risk class, base, age, house, personal | 0.0892 | 0.2403 | 0.2652 |
| hr.0011000 | risk class, base, race | 0.0892 | 0.2620 | 0.2209 |
| hr.0011001 | risk class, base, race, personal | 0.0892 | 0.2590 | 0.2344 |
| hr.0011010 | risk class, base, race, house | 0.0892 | 0.2519 | 0.2463 |
| hr.0011011 | risk class, base, race, house, personal | 0.0892 | 0.2478 | 0.2463 |
| hr.0011100 | risk class, base, race, age | 0.0892 | 0.2537 | 0.2541 |
| hr.0011101 | risk class, base, race, age, personal | 0.0892 | 0.2498 | 0.2581 |
| hr.0011110 | risk class, base, race, age, house | 0.0892 | 0.2403 | 0.2680 |
| hr.0011111 | risk class, base, race, age, house, personal | 0.0892 | 0.2382 | 0.2849 |
| hr.0100000 | risk class, high.rise | 0.0892 | 0.2679 | 0.2759 |
| hr.0100001 | risk class, high.rise, personal | 0.0892 | 0.2651 | 0.2383 |
| hr.0100010 | risk class, high.rise, house | 0.0892 | 0.2615 | 0.2449 |
| hr.0100011 | risk class, high.rise, house, personal | 0.0892 | 0.2580 | 0.2607 |
| hr.0100100 | risk class, high.rise, age | 0.0892 | 0.2577 | 0.2404 |
| hr.0100101 | risk class, high.rise, age, personal | 0.0892 | 0.2535 | 0.2550 |
| hr.0100110 | risk class, high.rise, age, house | 0.0892 | 0.2506 | 0.2701 |
| hr.0100111 | risk class, high.rise, age, house, personal | 0.0892 | 0.2474 | 0.2642 |
| hr.0101000 | risk class, high.rise, race | 0.0892 | 0.2640 | 0.2403 |
| hr.0101001 | risk class, high.rise, race, personal | 0.0892 | 0.2610 | 0.2323 |
| hr.0101010 | risk class, high.rise, race, house | 0.0892 | 0.2584 | 0.2502 |
| hr.0101011 | risk class, high.rise, race, house, personal | 0.0892 | 0.2553 | 0.2511 |
| hr.0101100 | risk class, high.rise, race, age | 0.0892 | 0.2549 | 0.2504 |
| hr.0101101 | risk class, high.rise, race, age, personal | 0.0892 | 0.2514 | 0.2629 |
| hr.0101110 | risk class, high.rise, race, age, house | 0.0892 | 0.2476 | 0.2732 |
| hr.0101111 | risk class, high.rise, race, age, house, personal | 0.0892 | 0.2455 | 0.2822 |
| hr.0110000 | risk class, high.rise, base | 0.0892 | 0.2682 | 0.2683 |
| hr.0110001 | risk class, high.rise, base, personal | 0.0892 | 0.2649 | 0.2389 |
| hr.0110010 | risk class, high.rise, base, house | 0.0892 | 0.2573 | 0.2532 |
| hr.0110011 | risk class, high.rise, base, house, personal | 0.0892 | 0.2506 | 0.2582 |
| hr.0110100 | risk class, high.rise, base, age | 0.0892 | 0.2567 | 0.2471 |
| hr.0110101 | risk class, high.rise, base, age, personal | 0.0892 | 0.2518 | 0.2643 |
| hr.0110110 | risk class, high.rise, base, age, house | 0.0892 | 0.2450 | 0.2689 |
| hr.0110111 | risk class, high.rise, base, age, house, personal | 0.0892 | 0.2404 | 0.2631 |
| hr.0111000 | risk class, high.rise, base, race | 0.0892 | 0.2619 | 0.2279 |
| hr.0111001 | risk class, high.rise, base, race, personal | 0.0892 | 0.2589 | 0.2415 |
| hr.0111010 | risk class, high.rise, base, race, house | 0.0892 | 0.2517 | 0.2571 |
| hr.0111011 | risk class, high.rise, base, race, house, personal | 0.0892 | 0.2478 | 0.2586 |
| hr.0111100 | risk class, high.rise, base, race, age | 0.0892 | 0.2535 | 0.2513 |
| hr.0111101 | risk class, high.rise, base, race, age, personal | 0.0892 | 0.2495 | 0.2669 |
| hr.0111110 | risk class, high.rise, base, race, age, house | 0.0892 | 0.2403 | 0.2696 |
| hr.0111111 | risk class, high.rise, base, race, age, house, personal | 0.0892 | 0.2384 | 0.2956 |
| hr.1000000 | risk class, time | 0.0892 | 0.2504 | 0.2155 |
| hr.1000001 | risk class, time, personal | 0.0892 | 0.2442 | 0.2191 |
| hr.1000010 | risk class, time, house | 0.0892 | 0.2453 | 0.2283 |
| hr.1000011 | risk class, time, house, personal | 0.0892 | 0.2416 | 0.2469 |
| hr.1000100 | risk class, time, age | 0.0892 | 0.2451 | 0.2384 |
| hr.1000101 | risk class, time, age, personal | 0.0892 | 0.2389 | 0.2541 |
| hr.1000110 | risk class, time, age, house | 0.0892 | 0.2407 | 0.2620 |
| hr.1000111 | risk class, time, age, house, personal | 0.0892 | 0.2360 | 0.2702 |
| hr.1001000 | risk class, time, race | 0.0892 | 0.2457 | 0.2154 |
| hr.1001001 | risk class, time, race, personal | 0.0892 | 0.2419 | 0.2285 |
| hr.1001010 | risk class, time, race, house | 0.0892 | 0.2435 | 0.2369 |
| hr.1001011 | risk class, time, race, house, personal | 0.0892 | 0.2403 | 0.2498 |
| hr.1001100 | risk class, time, race, age | 0.0892 | 0.2424 | 0.2575 |
| hr.1001101 | risk class, time, race, age, personal | 0.0892 | 0.2371 | 0.2700 |
| hr.1001110 | risk class, time, race, age, house | 0.0892 | 0.2385 | 0.2674 |
| hr.1001111 | risk class, time, race, age, house, personal | 0.0892 | 0.2347 | 0.2873 |
| hr.1010000 | risk class, time, base | 0.0892 | 0.2496 | 0.2155 |
| hr.1010001 | risk class, time, base, personal | 0.0892 | 0.2439 | 0.2267 |
| hr.1010010 | risk class, time, base, house | 0.0892 | 0.2436 | 0.2291 |
| hr.1010011 | risk class, time, base, house, personal | 0.0892 | 0.2383 | 0.2397 |
| hr.1010100 | risk class, time, base, age | 0.0892 | 0.2448 | 0.2436 |
| hr.1010101 | risk class, time, base, age, personal | 0.0892 | 0.2384 | 0.2572 |
| hr.1010110 | risk class, time, base, age, house | 0.0892 | 0.2381 | 0.2587 |
| hr.1010111 | risk class, time, base, age, house, personal | 0.0892 | 0.2328 | 0.2852 |
| hr.1011000 | risk class, time, base, race | 0.0892 | 0.2444 | 0.2161 |
| hr.1011001 | risk class, time, base, race, personal | 0.0892 | 0.2404 | 0.2277 |
| hr.1011010 | risk class, time, base, race, house | 0.0892 | 0.2409 | 0.2439 |
| hr.1011011 | risk class, time, base, race, house, personal | 0.0892 | 0.2369 | 0.2505 |
| hr.1011100 | risk class, time, base, race, age | 0.0892 | 0.2418 | 0.2479 |
| hr.1011101 | risk class, time, base, race, age, personal | 0.0892 | 0.2365 | 0.2646 |
| hr.1011110 | risk class, time, base, race, age, house | 0.0892 | 0.2348 | 0.2718 |
| hr.1011111 | risk class, time, base, race, age, house, personal | 0.0892 | 0.2314 | 0.2896 |
| hr.1100000 | risk class, time, high.rise | 0.0892 | 0.2493 | 0.2221 |
| hr.1100001 | risk class, time, high.rise, personal | 0.0892 | 0.2439 | 0.2253 |
| hr.1100010 | risk class, time, high.rise, house | 0.0892 | 0.2441 | 0.2358 |
| hr.1100011 | risk class, time, high.rise, house, personal | 0.0892 | 0.2410 | 0.2534 |
| hr.1100100 | risk class, time, high.rise, age | 0.0892 | 0.2443 | 0.2446 |
| hr.1100101 | risk class, time, high.rise, age, personal | 0.0892 | 0.2387 | 0.2639 |
| hr.1100110 | risk class, time, high.rise, age, house | 0.0892 | 0.2396 | 0.2650 |
| hr.1100111 | risk class, time, high.rise, age, house, personal | 0.0892 | 0.2356 | 0.2749 |
| hr.1101000 | risk class, time, high.rise, race | 0.0892 | 0.2453 | 0.2225 |
| hr.1101001 | risk class, time, high.rise, race, personal | 0.0892 | 0.2422 | 0.2355 |
| hr.1101010 | risk class, time, high.rise, race, house | 0.0892 | 0.2429 | 0.2428 |
| hr.1101011 | risk class, time, high.rise, race, house, personal | 0.0892 | 0.2400 | 0.2574 |
| hr.1101100 | risk class, time, high.rise, race, age | 0.0892 | 0.2421 | 0.2577 |
| hr.1101101 | risk class, time, high.rise, race, age, personal | 0.0892 | 0.2372 | 0.2746 |
| hr.1101110 | risk class, time, high.rise, race, age, house | 0.0892 | 0.2377 | 0.2716 |
| hr.1101111 | risk class, time, high.rise, race, age, house, personal | 0.0892 | 0.2346 | 0.2815 |
| hr.1110000 | risk class, time, high.rise, base | 0.0892 | 0.2486 | 0.2222 |
| hr.1110001 | risk class, time, high.rise, base, personal | 0.0892 | 0.2434 | 0.2353 |
| hr.1110010 | risk class, time, high.rise, base, house | 0.0892 | 0.2424 | 0.2445 |
| hr.1110011 | risk class, time, high.rise, base, house, personal | 0.0892 | 0.2379 | 0.2518 |
| hr.1110100 | risk class, time, high.rise, base, age | 0.0892 | 0.2440 | 0.2517 |
| hr.1110101 | risk class, time, high.rise, base, age, personal | 0.0892 | 0.2379 | 0.2704 |
| hr.1110110 | risk class, time, high.rise, base, age, house | 0.0892 | 0.2373 | 0.2643 |
| hr.1110111 | risk class, time, high.rise, base, age, house, personal | 0.0892 | 0.2326 | 0.2716 |
| hr.1111000 | risk class, time, high.rise, base, race | 0.0892 | 0.2438 | 0.2230 |
| hr.1111001 | risk class, time, high.rise, base, race, personal | 0.0892 | 0.2405 | 0.2400 |
| hr.1111010 | risk class, time, high.rise, base, race, house | 0.0892 | 0.2399 | 0.2456 |
| hr.1111011 | risk class, time, high.rise, base, race, house, personal | 0.0892 | 0.2368 | 0.2601 |
| hr.1111100 | risk class, time, high.rise, base, race, age | 0.0892 | 0.2414 | 0.2548 |
| hr.1111101 | risk class, time, high.rise, base, race, age, personal | 0.0892 | 0.2363 | 0.2801 |
| hr.1111110 | risk class, time, high.rise, base, race, age, house | 0.0892 | 0.2344 | 0.2718 |
| hr.1111111 | risk class, time, high.rise, base, race, age, house, personal | 0.0892 | 0.2315 | 0.2875 |

Table 5: Mean Square Errors of the injury models tested.

|  |  | **Mean Injuries** | **RMSE** | |
| --- | --- | --- | --- | --- |
| **Model Run** | **Predictors** | **Dummies** | **Separate** |
| constant |  | 0.0030 | 0.1356 | |
| rsk.clss | risk class | 0.0030 | 0.1356 | |
| lasso.min | risk class, time, high.rise, base, race, age, house, personal | 0.0030 | 0.6045 | |
| lasso.1se | risk class, time, high.rise, base, race, age, house, personal | 0.0030 | 0.6071 | |
| rForest | risk class, time, high.rise, base, race, age, house, personal | 0.0030 | 0.1374 | |
| hr.0000000 | risk class | 0.0030 | 0.1355 | 0.1356 |
| hr.0000001 | risk class, personal | 0.0030 | 0.1354 | 0.1487 |
| hr.0000010 | risk class, house | 0.0030 | 0.1355 | 0.1352 |
| hr.0000011 | risk class, house, personal | 0.0030 | 0.1353 | 0.1383 |
| hr.0000100 | risk class, age | 0.0030 | 0.1355 | 0.2024 |
| hr.0000101 | risk class, age, personal | 0.0030 | 0.1355 | 0.1369 |
| hr.0000110 | risk class, age, house | 0.0030 | 0.1354 | 1.68E+13 |
| hr.0000111 | risk class, age, house, personal | 0.0030 | 0.1354 | 1.84E+04 |
| hr.0001000 | risk class, race | 0.0030 | 0.1356 | 0.1378 |
| hr.0001001 | risk class, race, personal | 0.0030 | 0.1354 | 0.1393 |
| hr.0001010 | risk class, race, house | 0.0030 | 0.1354 | 0.1358 |
| hr.0001011 | risk class, race, house, personal | 0.0030 | 0.1354 | 0.1347 |
| hr.0001100 | risk class, race, age | 0.0030 | 0.1355 | 0.1367 |
| hr.0001101 | risk class, race, age, personal | 0.0030 | 0.1355 | 9.38E+03 |
| hr.0001110 | risk class, race, age, house | 0.0030 | 0.1354 | 6.12E+29 |
| hr.0001111 | risk class, race, age, house, personal | 0.0030 | 0.1355 | 3.69E+04 |
| hr.0010000 | risk class, base | 0.0030 | 0.1355 | 0.1357 |
| hr.0010001 | risk class, base, personal | 0.0030 | 0.1354 | 0.1366 |
| hr.0010010 | risk class, base, house | 0.0030 | 0.1354 | 0.1351 |
| hr.0010011 | risk class, base, house, personal | 0.0030 | 0.1353 | 35.9960 |
| hr.0010100 | risk class, base, age | 0.0030 | 0.1355 | 0.1407 |
| hr.0010101 | risk class, base, age, personal | 0.0030 | 0.1355 | 2.18E+39 |
| hr.0010110 | risk class, base, age, house | 0.0030 | 0.1354 | 7.64E+29 |
| hr.0010111 | risk class, base, age, house, personal | 0.0030 | 0.1354 | 2.67E+04 |
| hr.0011000 | risk class, base, race | 0.0030 | 0.1355 | 0.1358 |
| hr.0011001 | risk class, base, race, personal | 0.0030 | 0.1354 | 0.1349 |
| hr.0011010 | risk class, base, race, house | 0.0030 | 0.1354 | 0.1386 |
| hr.0011011 | risk class, base, race, house, personal | 0.0030 | 0.1354 | 1.7652 |
| hr.0011100 | risk class, base, race, age | 0.0030 | 0.1355 | 0.1365 |
| hr.0011101 | risk class, base, race, age, personal | 0.0030 | 0.1354 | 1.49E+04 |
| hr.0011110 | risk class, base, race, age, house | 0.0030 | 0.1354 | 1.60E+17 |
| hr.0011111 | risk class, base, race, age, house, personal | 0.0030 | 0.1354 | 5.20E+04 |
| hr.0100000 | risk class, high.rise | 0.0030 | 0.1355 | 0.1356 |
| hr.0100001 | risk class, high.rise, personal | 0.0030 | 0.1354 | 0.1485 |
| hr.0100010 | risk class, high.rise, house | 0.0030 | 0.1354 | 0.1500 |
| hr.0100011 | risk class, high.rise, house, personal | 0.0030 | 0.1352 | 0.1378 |
| hr.0100100 | risk class, high.rise, age | 0.0030 | 0.1354 | 0.2022 |
| hr.0100101 | risk class, high.rise, age, personal | 0.0030 | 0.1354 | 0.1364 |
| hr.0100110 | risk class, high.rise, age, house | 0.0030 | 0.1354 | 1.89E+11 |
| hr.0100111 | risk class, high.rise, age, house, personal | 0.0030 | 0.1353 | 1.87E+04 |
| hr.0101000 | risk class, high.rise, race | 0.0030 | 0.1356 | 0.1376 |
| hr.0101001 | risk class, high.rise, race, personal | 0.0030 | 0.1353 | 0.1359 |
| hr.0101010 | risk class, high.rise, race, house | 0.0030 | 0.1353 | 0.2220 |
| hr.0101011 | risk class, high.rise, race, house, personal | 0.0030 | 0.1353 | **0.1341** |
| hr.0101100 | risk class, high.rise, race, age | 0.0030 | 0.1355 | 0.1363 |
| hr.0101101 | risk class, high.rise, race, age, personal | 0.0030 | 0.1354 | 9.24E+03 |
| hr.0101110 | risk class, high.rise, race, age, house | 0.0030 | 0.1354 | 5.69E+34 |
| hr.0101111 | risk class, high.rise, race, age, house, personal | 0.0030 | 0.1354 | 3.73E+04 |
| hr.0110000 | risk class, high.rise, base | 0.0030 | 0.1355 | 0.1357 |
| hr.0110001 | risk class, high.rise, base, personal | 0.0030 | 0.1354 | 0.1364 |
| hr.0110010 | risk class, high.rise, base, house | 0.0030 | 0.1354 | 0.1353 |
| hr.0110011 | risk class, high.rise, base, house, personal | 0.0030 | 0.1352 | 28.4462 |
| hr.0110100 | risk class, high.rise, base, age | 0.0030 | 0.1354 | 0.1402 |
| hr.0110101 | risk class, high.rise, base, age, personal | 0.0030 | 0.1354 | 6.16E+38 |
| hr.0110110 | risk class, high.rise, base, age, house | 0.0030 | 0.1354 | 1.63E+30 |
| hr.0110111 | risk class, high.rise, base, age, house, personal | 0.0030 | **0.1352** | 2.70E+04 |
| hr.0111000 | risk class, high.rise, base, race | 0.0030 | 0.1354 | 0.1356 |
| hr.0111001 | risk class, high.rise, base, race, personal | 0.0030 | 0.1353 | 0.1346 |
| hr.0111010 | risk class, high.rise, base, race, house | 0.0030 | 0.1353 | 0.1369 |
| hr.0111011 | risk class, high.rise, base, race, house, personal | 0.0030 | 0.1352 | 1.2336 |
| hr.0111100 | risk class, high.rise, base, race, age | 0.0030 | 0.1354 | 0.1357 |
| hr.0111101 | risk class, high.rise, base, race, age, personal | 0.0030 | 0.1353 | 1.58E+04 |
| hr.0111110 | risk class, high.rise, base, race, age, house | 0.0030 | 0.1353 | 6.69E+06 |
| hr.0111111 | risk class, high.rise, base, race, age, house, personal | 0.0030 | 0.1353 | 5.27E+04 |
| hr.1000000 | risk class, time | 0.0030 | 0.1355 | 0.1356 |
| hr.1000001 | risk class, time, personal | 0.0030 | 0.1354 | 0.1391 |
| hr.1000010 | risk class, time, house | 0.0030 | 0.1355 | 0.1350 |
| hr.1000011 | risk class, time, house, personal | 0.0030 | 0.1353 | 0.1359 |
| hr.1000100 | risk class, time, age | 0.0030 | 0.1355 | 0.2951 |
| hr.1000101 | risk class, time, age, personal | 0.0030 | 0.1355 | 0.1431 |
| hr.1000110 | risk class, time, age, house | 0.0030 | 0.1354 | 2.20E+03 |
| hr.1000111 | risk class, time, age, house, personal | 0.0030 | 0.1354 | 6.85E+05 |
| hr.1001000 | risk class, time, race | 0.0030 | 0.1356 | 0.1379 |
| hr.1001001 | risk class, time, race, personal | 0.0030 | 0.1354 | 0.1464 |
| hr.1001010 | risk class, time, race, house | 0.0030 | 0.1354 | 0.1356 |
| hr.1001011 | risk class, time, race, house, personal | 0.0030 | 0.1354 | 0.1350 |
| hr.1001100 | risk class, time, race, age | 0.0030 | 0.1355 | 0.1362 |
| hr.1001101 | risk class, time, race, age, personal | 0.0030 | 0.1354 | 1.03E+04 |
| hr.1001110 | risk class, time, race, age, house | 0.0030 | 0.1354 | 7.13E+14 |
| hr.1001111 | risk class, time, race, age, house, personal | 0.0030 | 0.1355 | 3.22E+04 |
| hr.1010000 | risk class, time, base | 0.0030 | 0.1355 | 0.1354 |
| hr.1010001 | risk class, time, base, personal | 0.0030 | 0.1354 | 0.1360 |
| hr.1010010 | risk class, time, base, house | 0.0030 | 0.1354 | 0.1351 |
| hr.1010011 | risk class, time, base, house, personal | 0.0030 | 0.1353 | 4.20E+10 |
| hr.1010100 | risk class, time, base, age | 0.0030 | 0.1355 | 2.1950 |
| hr.1010101 | risk class, time, base, age, personal | 0.0030 | 0.1355 | 5.65E+02 |
| hr.1010110 | risk class, time, base, age, house | 0.0030 | 0.1355 | 7.36E+15 |
| hr.1010111 | risk class, time, base, age, house, personal | 0.0030 | 0.1354 | 2.56E+04 |
| hr.1011000 | risk class, time, base, race | 0.0030 | 0.1354 | 0.1358 |
| hr.1011001 | risk class, time, base, race, personal | 0.0030 | 0.1354 | 0.1350 |
| hr.1011010 | risk class, time, base, race, house | 0.0030 | 0.1354 | 0.1390 |
| hr.1011011 | risk class, time, base, race, house, personal | 0.0030 | 0.1354 | 0.1371 |
| hr.1011100 | risk class, time, base, race, age | 0.0030 | 0.1355 | 0.3003 |
| hr.1011101 | risk class, time, base, race, age, personal | 0.0030 | 0.1354 | 1.39E+04 |
| hr.1011110 | risk class, time, base, race, age, house | 0.0030 | 0.1354 | 4.08E+06 |
| hr.1011111 | risk class, time, base, race, age, house, personal | 0.0030 | 0.1354 | 5.03E+04 |
| hr.1100000 | risk class, time, high.rise | 0.0030 | 0.1355 | 0.1355 |
| hr.1100001 | risk class, time, high.rise, personal | 0.0030 | 0.1354 | 0.1387 |
| hr.1100010 | risk class, time, high.rise, house | 0.0030 | 0.1354 | 0.1592 |
| hr.1100011 | risk class, time, high.rise, house, personal | 0.0030 | 0.1352 | 0.1351 |
| hr.1100100 | risk class, time, high.rise, age | 0.0030 | 0.1354 | 0.2198 |
| hr.1100101 | risk class, time, high.rise, age, personal | 0.0030 | 0.1354 | 0.1426 |
| hr.1100110 | risk class, time, high.rise, age, house | 0.0030 | 0.1354 | 2.21E+03 |
| hr.1100111 | risk class, time, high.rise, age, house, personal | 0.0030 | 0.1353 | 1.76E+06 |
| hr.1101000 | risk class, time, high.rise, race | 0.0030 | 0.1356 | 0.1376 |
| hr.1101001 | risk class, time, high.rise, race, personal | 0.0030 | 0.1353 | 0.1377 |
| hr.1101010 | risk class, time, high.rise, race, house | 0.0030 | 0.1353 | 0.3407 |
| hr.1101011 | risk class, time, high.rise, race, house, personal | 0.0030 | 0.1353 | 0.1341 |
| hr.1101100 | risk class, time, high.rise, race, age | 0.0030 | 0.1355 | 0.1354 |
| hr.1101101 | risk class, time, high.rise, race, age, personal | 0.0030 | 0.1354 | 1.08E+04 |
| hr.1101110 | risk class, time, high.rise, race, age, house | 0.0030 | 0.1354 | 1.71E+25 |
| hr.1101111 | risk class, time, high.rise, race, age, house, personal | 0.0030 | 0.1354 | 3.46E+04 |
| hr.1110000 | risk class, time, high.rise, base | 0.0030 | 0.1355 | 0.1353 |
| hr.1110001 | risk class, time, high.rise, base, personal | 0.0030 | 0.1354 | 0.1355 |
| hr.1110010 | risk class, time, high.rise, base, house | 0.0030 | 0.1354 | 0.1356 |
| hr.1110011 | risk class, time, high.rise, base, house, personal | 0.0030 | 0.1352 | 2.72E+10 |
| hr.1110100 | risk class, time, high.rise, base, age | 0.0030 | 0.1354 | 0.9193 |
| hr.1110101 | risk class, time, high.rise, base, age, personal | 0.0030 | 0.1354 | 3.65E+28 |
| hr.1110110 | risk class, time, high.rise, base, age, house | 0.0030 | 0.1354 | 1.95E+18 |
| hr.1110111 | risk class, time, high.rise, base, age, house, personal | 0.0030 | 0.1352 | 2.61E+04 |
| hr.1111000 | risk class, time, high.rise, base, race | 0.0030 | 0.1354 | 0.1356 |
| hr.1111001 | risk class, time, high.rise, base, race, personal | 0.0030 | 0.1353 | 0.1348 |
| hr.1111010 | risk class, time, high.rise, base, race, house | 0.0030 | 0.1353 | 0.1400 |
| hr.1111011 | risk class, time, high.rise, base, race, house, personal | 0.0030 | 0.1352 | 3.26E+14 |
| hr.1111100 | risk class, time, high.rise, base, race, age | 0.0030 | 0.1354 | 0.1357 |
| hr.1111101 | risk class, time, high.rise, base, race, age, personal | 0.0030 | 0.1353 | 1.43E+04 |
| hr.1111110 | risk class, time, high.rise, base, race, age, house | 0.0030 | 0.1353 | 2.54E+07 |
| hr.1111111 | risk class, time, high.rise, base, race, age, house, personal | 0.0030 | 0.1353 | 5.11E+04 |

Table 6: Mean Square Errors of the fire-death models tested.

|  |  | **Mean Deaths** | **RMSE** | |
| --- | --- | --- | --- | --- |
| **Model Run** | **Predictors** | **Dummies** | **Separate** |
| constant |  | 0.0002 | 0.0157 | |
| rsk.clss | risk class | 0.0002 | 0.0157 | |
| lasso.min | risk class, time, high.rise, base, race, age, house, personal | 0.0002 | 0.5901 | |
| lasso.1se | risk class, time, high.rise, base, race, age, house, personal | 0.0002 | 0.5917 | |
| rForest | risk class, time, high.rise, base, race, age, house, personal | 0.0002 | **+** | |
| hr.0000000 | risk class | 0.0002 | 0.0157 | 0.0157 |
| hr.0000001 | risk class, personal | 0.0002 | 0.0156 | Infinity |
| hr.0000010 | risk class, house | 0.0002 | 0.0156 | 0.0176 |
| hr.0000011 | risk class, house, personal | 0.0002 | 0.0147 | 4.69E+09 |
| hr.0000100 | risk class, age | 0.0002 | 0.0118 | 4.73E+07 |
| hr.0000101 | risk class, age, personal | 0.0002 | 0.0107 | 4.17E+20 |
| hr.0000110 | risk class, age, house | 0.0002 | 0.0107 | 8.46E+12 |
| hr.0000111 | risk class, age, house, personal | 0.0002 | 0.0102 | 2.09E+129 |
| hr.0001000 | risk class, race | 0.0002 | 0.0157 | 0.0160 |
| hr.0001001 | risk class, race, personal | 0.0002 | 0.0155 | 8.31E+38 |
| hr.0001010 | risk class, race, house | 0.0002 | 0.0155 | 0.1351 |
| hr.0001011 | risk class, race, house, personal | 0.0002 | 0.0141 | 1.45E+29 |
| hr.0001100 | risk class, race, age | 0.0002 | 0.0115 | 1.66E+28 |
| hr.0001101 | risk class, race, age, personal | 0.0002 | 0.0105 | 3.29E+24 |
| hr.0001110 | risk class, race, age, house | 0.0002 | 0.0107 | 5.09E+20 |
| hr.0001111 | risk class, race, age, house, personal | 0.0002 | 0.0101 | 7.50E+109 |
| hr.0010000 | risk class, base | 0.0002 | 0.0157 | 0.0157 |
| hr.0010001 | risk class, base, personal | 0.0002 | 0.0158 | 1.53E+26 |
| hr.0010010 | risk class, base, house | 0.0002 | 0.0154 | 1.34E+26 |
| hr.0010011 | risk class, base, house, personal | 0.0002 | 0.0142 | 1.42E+00 |
| hr.0010100 | risk class, base, age | 0.0002 | 0.0111 | 7.19E+28 |
| hr.0010101 | risk class, base, age, personal | 0.0002 | 0.0103 | 9.20E+12 |
| hr.0010110 | risk class, base, age, house | 0.0002 | 0.0099 | 2.11E+14 |
| hr.0010111 | risk class, base, age, house, personal | 0.0002 | 0.0095 | 5.70E+79 |
| hr.0011000 | risk class, base, race | 0.0002 | 0.0157 | 0.0158 |
| hr.0011001 | risk class, base, race, personal | 0.0002 | 0.0153 | 5.25E+13 |
| hr.0011010 | risk class, base, race, house | 0.0002 | 0.0153 | 0.0478 |
| hr.0011011 | risk class, base, race, house, personal | 0.0002 | 0.0139 | Infinity |
| hr.0011100 | risk class, base, race, age | 0.0002 | 0.0109 | 3.49E+16 |
| hr.0011101 | risk class, base, race, age, personal | 0.0002 | 0.0103 | 2.32E+55 |
| hr.0011110 | risk class, base, race, age, house | 0.0002 | 0.0099 | 3.22E+10 |
| hr.0011111 | risk class, base, race, age, house, personal | 0.0002 | 0.0095 | 2.57E+49 |
| hr.0100000 | risk class, high.rise | 0.0002 | 0.0157 | 0.0157 |
| hr.0100001 | risk class, high.rise, personal | 0.0002 | 0.0153 | Infinity |
| hr.0100010 | risk class, high.rise, house | 0.0002 | 0.0156 | 0.0237 |
| hr.0100011 | risk class, high.rise, house, personal | 0.0002 | 0.0146 | Infinity |
| hr.0100100 | risk class, high.rise, age | 0.0002 | 0.0112 | 1.06E+84 |
| hr.0100101 | risk class, high.rise, age, personal | 0.0002 | 0.0104 | Infinity |
| hr.0100110 | risk class, high.rise, age, house | 0.0002 | 0.0106 | 1.75E+134 |
| hr.0100111 | risk class, high.rise, age, house, personal | 0.0002 | 0.0101 | 1.65E+119 |
| hr.0101000 | risk class, high.rise, race | 0.0002 | 0.0157 | 0.0162 |
| hr.0101001 | risk class, high.rise, race, personal | 0.0002 | 0.0151 | 1.07E+43 |
| hr.0101010 | risk class, high.rise, race, house | 0.0002 | 0.0155 | 0.0509 |
| hr.0101011 | risk class, high.rise, race, house, personal | 0.0002 | 0.0139 | 2.87E+62 |
| hr.0101100 | risk class, high.rise, race, age | 0.0002 | 0.0109 | 3.31E+107 |
| hr.0101101 | risk class, high.rise, race, age, personal | 0.0002 | 0.0103 | Infinity |
| hr.0101110 | risk class, high.rise, race, age, house | 0.0002 | 0.0106 | Infinity |
| hr.0101111 | risk class, high.rise, race, age, house, personal | 0.0002 | 0.0100 | 2.19E+115 |
| hr.0110000 | risk class, high.rise, base | 0.0002 | 0.0157 | 0.0158 |
| hr.0110001 | risk class, high.rise, base, personal | 0.0002 | 0.0152 | 0.0086 |
| hr.0110010 | risk class, high.rise, base, house | 0.0002 | 0.0153 | 7.57E+27 |
| hr.0110011 | risk class, high.rise, base, house, personal | 0.0002 | 0.0139 | 1.31E+11 |
| hr.0110100 | risk class, high.rise, base, age | 0.0002 | 0.0106 | 3.00E+92 |
| hr.0110101 | risk class, high.rise, base, age, personal | 0.0002 | 0.0100 | 4.93E+91 |
| hr.0110110 | risk class, high.rise, base, age, house | 0.0002 | 0.0099 | Infinity |
| hr.0110111 | risk class, high.rise, base, age, house, personal | 0.0002 | 0.0095 | 3.12E+99 |
| hr.0111000 | risk class, high.rise, base, race | 0.0002 | 0.0156 | 0.0161 |
| hr.0111001 | risk class, high.rise, base, race, personal | 0.0002 | 0.0149 | 6.84E+21 |
| hr.0111010 | risk class, high.rise, base, race, house | 0.0002 | 0.0152 | 6.7242 |
| hr.0111011 | risk class, high.rise, base, race, house, personal | 0.0002 | 0.0136 | Infinity |
| hr.0111100 | risk class, high.rise, base, race, age | 0.0002 | 0.0104 | 7.42E+122 |
| hr.0111101 | risk class, high.rise, base, race, age, personal | 0.0002 | 0.0099 | 5.48E+89 |
| hr.0111110 | risk class, high.rise, base, race, age, house | 0.0002 | 0.0099 | Infinity |
| hr.0111111 | risk class, high.rise, base, race, age, house, personal | 0.0002 | 0.0094 | 3.33E+104 |
| hr.1000000 | risk class, time | 0.0002 | 0.0157 | 0.0157 |
| hr.1000001 | risk class, time, personal | 0.0002 | 0.0155 | 5.43E+07 |
| hr.1000010 | risk class, time, house | 0.0002 | 0.0156 | 0.0268 |
| hr.1000011 | risk class, time, house, personal | 0.0002 | 0.0147 | 3.56E+10 |
| hr.1000100 | risk class, time, age | 0.0002 | 0.0118 | 3.49E+09 |
| hr.1000101 | risk class, time, age, personal | 0.0002 | 0.0107 | 3.34E+27 |
| hr.1000110 | risk class, time, age, house | 0.0002 | 0.0107 | 2.03E+18 |
| hr.1000111 | risk class, time, age, house, personal | 0.0002 | 0.0102 | 5.66E+125 |
| hr.1001000 | risk class, time, race | 0.0002 | 0.0157 | 0.0160 |
| hr.1001001 | risk class, time, race, personal | 0.0002 | 0.0154 | 3.38E+16 |
| hr.1001010 | risk class, time, race, house | 0.0002 | 0.0155 | 1.0271 |
| hr.1001011 | risk class, time, race, house, personal | 0.0002 | 0.0141 | 5.85E+06 |
| hr.1001100 | risk class, time, race, age | 0.0002 | 0.0115 | 1.23E+24 |
| hr.1001101 | risk class, time, race, age, personal | 0.0002 | 0.0105 | Infinity |
| hr.1001110 | risk class, time, race, age, house | 0.0002 | 0.0107 | 8.05E+30 |
| hr.1001111 | risk class, time, race, age, house, personal | 0.0002 | 0.0101 | 4.03E+116 |
| hr.1010000 | risk class, time, base | 0.0002 | 0.0157 | 0.0304 |
| hr.1010001 | risk class, time, base, personal | 0.0002 | 0.0158 | 1.79E+12 |
| hr.1010010 | risk class, time, base, house | 0.0002 | 0.0154 | 7.40E+19 |
| hr.1010011 | risk class, time, base, house, personal | 0.0002 | 0.0141 | Infinity |
| hr.1010100 | risk class, time, base, age | 0.0002 | 0.0111 | 1.80E+15 |
| hr.1010101 | risk class, time, base, age, personal | 0.0002 | 0.0103 | 8.43E+13 |
| hr.1010110 | risk class, time, base, age, house | 0.0002 | 0.0099 | 5.47E+33 |
| hr.1010111 | risk class, time, base, age, house, personal | 0.0002 | 0.0095 | 1.55E+74 |
| hr.1011000 | risk class, time, base, race | 0.0002 | 0.0157 | 8.43E+129 |
| hr.1011001 | risk class, time, base, race, personal | 0.0002 | 0.0153 | 0.0114 |
| hr.1011010 | risk class, time, base, race, house | 0.0002 | 0.0152 | 1.56E+07 |
| hr.1011011 | risk class, time, base, race, house, personal | 0.0002 | 0.0139 | Infinity |
| hr.1011100 | risk class, time, base, race, age | 0.0002 | 0.0109 | 1.05E+19 |
| hr.1011101 | risk class, time, base, race, age, personal | 0.0002 | 0.0103 | 1.97E+68 |
| hr.1011110 | risk class, time, base, race, age, house | 0.0002 | 0.0099 | 1.07E+23 |
| hr.1011111 | risk class, time, base, race, age, house, personal | 0.0002 | 0.0095 | 3.11E+73 |
| hr.1100000 | risk class, time, high.rise | 0.0002 | 0.0157 | 0.0157 |
| hr.1100001 | risk class, time, high.rise, personal | 0.0002 | 0.0153 | Infinity |
| hr.1100010 | risk class, time, high.rise, house | 0.0002 | 0.0156 | 0.0357 |
| hr.1100011 | risk class, time, high.rise, house, personal | 0.0002 | 0.0146 | Infinity |
| hr.1100100 | risk class, time, high.rise, age | 0.0002 | 0.0112 | 3.67E+100 |
| hr.1100101 | risk class, time, high.rise, age, personal | 0.0002 | 0.0104 | Infinity |
| hr.1100110 | risk class, time, high.rise, age, house | 0.0002 | 0.0106 | 8.22E+144 |
| hr.1100111 | risk class, time, high.rise, age, house, personal | 0.0002 | 0.0101 | 9.72E+122 |
| hr.1101000 | risk class, time, high.rise, race | 0.0002 | 0.0157 | 0.0162 |
| hr.1101001 | risk class, time, high.rise, race, personal | 0.0002 | 0.0151 | 1.68E+21 |
| hr.1101010 | risk class, time, high.rise, race, house | 0.0002 | 0.0154 | 0.1798 |
| hr.1101011 | risk class, time, high.rise, race, house, personal | 0.0002 | 0.0138 | 2.86E+10 |
| hr.1101100 | risk class, time, high.rise, race, age | 0.0002 | 0.0109 | 6.28E+96 |
| hr.1101101 | risk class, time, high.rise, race, age, personal | 0.0002 | 0.0103 | Infinity |
| hr.1101110 | risk class, time, high.rise, race, age, house | 0.0002 | 0.0106 | 2.26E+149 |
| hr.1101111 | risk class, time, high.rise, race, age, house, personal | 0.0002 | 0.0100 | 5.49E+106 |
| hr.1110000 | risk class, time, high.rise, base | 0.0002 | 0.0157 | 0.0301 |
| hr.1110001 | risk class, time, high.rise, base, personal | 0.0002 | 0.0152 | 7.51E+12 |
| hr.1110010 | risk class, time, high.rise, base, house | 0.0002 | 0.0153 | 7.91E+18 |
| hr.1110011 | risk class, time, high.rise, base, house, personal | 0.0002 | 0.0139 | 6.98E+03 |
| hr.1110100 | risk class, time, high.rise, base, age | 0.0002 | 0.0106 | 5.49E+71 |
| hr.1110101 | risk class, time, high.rise, base, age, personal | 0.0002 | 0.0100 | 3.24E+22 |
| hr.1110110 | risk class, time, high.rise, base, age, house | 0.0002 | 0.0098 | Infinity |
| hr.1110111 | risk class, time, high.rise, base, age, house, personal | 0.0002 | 0.0095 | 3.28E+96 |
| hr.1111000 | risk class, time, high.rise, base, race | 0.0002 | 0.0156 | 4.34E+130 |
| hr.1111001 | risk class, time, high.rise, base, race, personal | 0.0002 | 0.0149 | 0.0110 |
| hr.1111010 | risk class, time, high.rise, base, race, house | 0.0002 | 0.0152 | 3.78E+06 |
| hr.1111011 | risk class, time, high.rise, base, race, house, personal | 0.0002 | 0.0136 | Infinity |
| hr.1111100 | risk class, time, high.rise, base, race, age | 0.0002 | 0.0104 | 4.34E+96 |
| hr.1111101 | risk class, time, high.rise, base, race, age, personal | 0.0002 | 0.0099 | 3.83E+55 |
| hr.1111110 | risk class, time, high.rise, base, race, age, house | 0.0002 | 0.0098 | 6.17E+146 |
| hr.1111111 | risk class, time, high.rise, base, race, age, house, personal | 0.0002 | 0.0094 | 6.70E+94 |

**Appendix I**

The “hr\_parcels” table is primarily a subset of the CoreLogic Parcels table. I have added or modified a handful of fields to make it more useful, and I have added a GIST index on the geog field.

As mentioned before, the high-risk category includes several different classes of structure and use where I expect the risks to be significantly different. The ‘unit\_type’ field contains more than 500 different descriptions, and was a first attempt at categorizing parcels into risk groups. The field ‘risk\_class’ is an attempt to condense the ‘risk\_data’ and ‘unit\_type’ fields down to a manageable set, while still identifying distinctly different types of parcels by risk.

Description of the table is as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| **Column** | **Type** | **CoreLogic Field** | **Description** |
| row.names | text | No | Index field |
| ogc\_fid | integer | Yes | Index field from the CoreLogic table |
| state\_code | integer | Yes | State FIPS Code |
| cnty\_code | integer | Yes | County FIPS Code |
| census\_tr | double precision | Yes | Census block code |
| geoid | text | No | Standard Census Geographic ID code at the census tract level |
| std\_addr | text | Yes | Physical Address |
| std\_city | text | Yes | City |
| std\_state | text | Yes | State |
| std\_zip | integer | Yes | ZIP Code |
| std\_plus | text | Yes | ZIP+4 |
| land\_use | integer | Yes | CoreLogic land use code |
| prop\_ind | integer | Yes | A short property use indicator. |
| m\_home\_ind | text | Yes | ‘Y’ means there is a mobile home on the property |
| own\_cp\_ind | text | Yes | Whether the owner is a corporation. |
| ubld\_sq\_ft | integer | Yes | Assessed building square footage |
| bld\_sq\_ft | integer | Yes | Total building square footage |
| liv\_sq\_ft | integer | Yes | Square footage of the living space |
| gr\_sq\_ft | integer | Yes | Gross square footage of the building |
| yr\_blt | integer | Yes | Year Built |
| eff\_yr\_blt | integer | Yes | Year of the most recent renovation |
| story\_nbr | double precision | Yes | Number of Stories from the CoreLogic data set. |
| bld\_units | integer | Yes | Total number of buildings on the parcel |
| units\_nbr | integer | Yes | Number of residential, apartment, or business units |
| risk\_category | text | Tyler | ‘High’ means that Tyler has identified it as a high-risk parcel from other data sets |
| geog | geography | Yes | This is the wkb\_geometry field from the CoreLogic table, converted to a geography type. |
| risk\_data | jsonb | Tyler | All the information from the other data sets used by Tyler have been included in this field. |
| unit\_type | text | No | Unit Type is drawn from the ‘risk\_data’ field |
| hr\_floors | double precision | No | Number of floors as contained in the ‘risk\_data’ field. This information only exists for high-rises |
| risk\_class | text | No | Risk Class. This is a condensation of the unit\_type data. |

This query constructs the ‘hr\_fires’ intermediate table. The table consists of all the high-risk parcels, joined with any fires that overlap the bounding box for a parcel. Much of the complexity of the query is to get census tract values (the various ‘geoid’ fields) for as many parcels as possible.

WITH

y AS (

SELECT generate\_series(2007, 2013) AS year

), p0 AS (

SELECT y.year,

p."row.names" AS parcel\_id,

p.geoid AS p\_geoid,

CASE

WHEN floor((p.land\_use / 100)::double precision) = 1::double precision THEN 'Yes'::text

ELSE 'No'::text

END AS res\_corelogic,

CASE

WHEN lower(p.unit\_type) ~~ '%apartment%'::text OR lower(p.unit\_type) ~~ '%residen%'::text OR lower(p.unit\_type) ~~ '%housing%'::text OR lower(p.unit\_type) ~~ '%living%'::text OR lower(p.unit\_type) ~~ '%dormitory%'::text THEN 'Yes'::text

ELSE 'No'::text

END AS res\_other,

p.bld\_units,

p.hr\_floors,

p.yr\_blt,

p.eff\_yr\_blt,

p.risk\_class

FROM hr\_parcels p CROSS JOIN y

), p1 AS (

SELECT p."row.names" AS parcel\_id,

f.geoid AS f\_geoid,

f.inc\_type,

f.year,

f.struc,

f.fire\_sprd,

f.ff\_death,

f.oth\_death,

f.ff\_inj,

f.oth\_inj

FROM hr\_parcels p LEFT JOIN coded\_fires f ON p.geog && f.geog

), v1 AS (

SELECT p1\_1.parcel\_id,

p1\_1.f\_geoid,

sum(

CASE

WHEN p1\_1.f\_geoid IS NOT NULL AND p1\_1.f\_geoid <> ''::text THEN 1

ELSE 0

END) AS n,

row\_number() OVER (PARTITION BY p1\_1.parcel\_id ORDER BY (sum(

CASE

WHEN p1\_1.f\_geoid IS NOT NULL AND p1\_1.f\_geoid <> ''::text THEN 1

ELSE 0

END)) DESC) AS r

FROM p1 p1\_1

WHERE p1\_1.f\_geoid <> ''::text AND p1\_1.f\_geoid IS NOT NULL

GROUP BY p1\_1.parcel\_id, p1\_1.f\_geoid

), v2 AS (

SELECT v1.parcel\_id,

v1.f\_geoid,

v1.n,

v1.r

FROM v1

WHERE v1.r = 1

), v3 AS (

SELECT hr."row.names" AS parcel\_id,

bg.geoid AS c\_geoid

FROM ( SELECT \* FROM hr\_parcels WHERE hr\_parcels.geoid IS NULL) hr

LEFT JOIN bg.census2010tr bg ON st\_contains(bg.geom2, hr.geog::geometry)

)

SELECT p0.year,

p0.parcel\_id,

CASE

WHEN p0.p\_geoid IS NOT NULL THEN p0.p\_geoid

WHEN v2.f\_geoid IS NOT NULL THEN v2.f\_geoid

WHEN v3.c\_geoid IS NOT NULL THEN v3.c\_geoid::text

ELSE NULL::text

END AS geoid,

CASE

WHEN p0.p\_geoid IS NOT NULL THEN 'CoreLogic'::text

WHEN v2.f\_geoid IS NOT NULL THEN 'Fire Location'::text

WHEN v3.c\_geoid IS NOT NULL THEN 'Census Location'::text

ELSE NULL::text

END AS geoid\_source,

p0.res\_corelogic,

p0.res\_other,

p0.bld\_units,

p0.hr\_floors,

CASE

WHEN p0.eff\_yr\_blt IS NOT NULL THEN p0.eff\_yr\_blt

ELSE p0.yr\_blt

END AS eff\_yr,

p0.risk\_class,

p1.inc\_type,

p1.struc,

p1.fire\_sprd,

p1.ff\_death,

p1.oth\_death,

p1.ff\_inj,

p1.oth\_inj

FROM p0

LEFT JOIN p1 ON p0.parcel\_id = p1.parcel\_id AND p0.year = p1.year

LEFT JOIN v2 ON p0.parcel\_id = v2.parcel\_id

LEFT JOIN v3 ON p0.parcel\_id = v3.parcel\_id

WHERE p0.year >= p0.yr\_blt OR p0.yr\_blt IS NULL

This query constructs the ‘high\_risk’ table. The table consists of all the high-risk parcels, joined with any fires that overlap the bounding box for a parcel. Much of the complexity of the query is to get census tract values (the various ‘geoid’ fields) for as many parcels as possible.

WITH

f AS (

SELECT hr\_fire.year,

hr\_fire.parcel\_id,

hr\_fire.geoid,

hr\_fire.geoid\_source,

hr\_fire.res\_corelogic,

hr\_fire.res\_other,

hr\_fire.bld\_units,

hr\_fire.hr\_floors,

hr\_fire.eff\_yr,

hr\_fire.risk\_class,

sum(

CASE

WHEN hr\_fire.struc = 'Y'::text AND hr\_fire.inc\_type ~~ '11%'::text THEN 1

ELSE 0

END) AS fires,

sum(

CASE

WHEN hr\_fire.struc = 'Y'::text AND hr\_fire.inc\_type ~~ '11%'::text AND (hr\_fire.fire\_sprd IS NOT NULL OR (hr\_fire.inc\_type = ANY (ARRAY['113'::text, '114'::text, '115'::text, '116'::text, '117'::text, '118'::text]))) THEN 1

ELSE 0

END) AS size\_1,

sum(

CASE

WHEN hr\_fire.struc = 'Y'::text AND hr\_fire.inc\_type ~~ '11%'::text AND (hr\_fire.fire\_sprd = ANY (ARRAY['3'::text, '4'::text, '5'::text])) THEN 1

ELSE 0

END) AS size\_2,

sum(

CASE

WHEN hr\_fire.struc = 'Y'::text AND hr\_fire.inc\_type ~~ '11%'::text AND hr\_fire.fire\_sprd = '5'::text THEN 1

ELSE 0

END) AS size\_3,

sum(

CASE

WHEN hr\_fire.struc = 'Y'::text AND hr\_fire.inc\_type ~~ '11%'::text THEN hr\_fire.ff\_death + hr\_fire.oth\_death

ELSE 0

END) AS deaths,

sum(

CASE

WHEN hr\_fire.struc = 'Y'::text AND hr\_fire.inc\_type ~~ '11%'::text THEN hr\_fire.ff\_inj + hr\_fire.oth\_inj

ELSE 0

END) AS injuries

FROM hr\_fire

GROUP BY hr\_fire.year, hr\_fire.parcel\_id, hr\_fire.geoid, hr\_fire.geoid\_source, hr\_fire.res\_corelogic, hr\_fire.res\_other,   
 hr\_fire.bld\_units, hr\_fire.hr\_floors, hr\_fire.eff\_yr, hr\_fire.risk\_class

), d AS (

SELECT i.year,

g.firecares\_id AS fd\_id,

g.fd\_size,

sum(i.incidents) AS incidents,

sum(i.incidents\_loc) AS located,

sum(i.fires) AS dept\_fires

FROM dept\_incidents i JOIN bg.gov\_units g ON i.state = g.state AND i.fdid = g.fdid

WHERE i.year > 2006 AND i.year < 2014

GROUP BY i.year, g.firecares\_id, g.fd\_size

)

SELECT f.year,

f.parcel\_id,

f.geoid,

f.geoid\_source,

t.region,

t.state,

t.fc\_dept\_id AS fd\_id,

d.fd\_size,

f.res\_corelogic,

f.res\_other,

f.bld\_units,

f.hr\_floors,

f.eff\_yr,

f.risk\_class,

d.incidents AS dept\_incidents,

d.dept\_fires,

CASE

WHEN d.incidents > 0::numeric THEN (d.located / d.incidents)::double precision

WHEN d.incidents = 0::numeric THEN 'Infinity'::double precision

ELSE 'NaN'::double precision

END AS f\_located,

f.fires,

f.size\_1,

f.size\_2,

f.size\_3,

f.deaths,

f.injuries,

CASE

WHEN acs."B25002\_002E" > 0 THEN acs."B01001\_001E"::double precision / acs."B25002\_002E"::double precision

WHEN acs."B25002\_002E" = 0 AND acs."B01001\_001E" > 0 THEN 'Infinity'::double precision

ELSE 'NaN'::double precision

END AS ave\_hh\_sz,

acs."B01001\_001E" AS pop,

acs."B02001\_003E" AS black,

acs."B02001\_004E" AS amer\_es,

acs."B02001\_005E" + acs."B02001\_006E" + acs."B02001\_007E" + acs."B02001\_008E" AS other,

acs."B03003\_003E" AS hispanic,

acs."B01001\_002E" AS males,

acs."B01001\_003E" + acs."B01001\_027E" AS age\_under5,

acs."B01001\_004E" + acs."B01001\_028E" AS age\_5\_9,

acs."B01001\_005E" + acs."B01001\_029E" AS age\_10\_14,

acs."B01001\_006E" + acs."B01001\_007E" + acs."B01001\_030E" + acs."B01001\_031E" AS age\_15\_19,

acs."B01001\_008E" + acs."B01001\_009E" + acs."B01001\_010E" + acs."B01001\_032E" + acs."B01001\_033E" + acs."B01001\_034E" AS age\_20\_24,

acs."B01001\_013E" + acs."B01001\_014E" + acs."B01001\_037E" + acs."B01001\_038E" AS age\_35\_44,

acs."B01001\_015E" + acs."B01001\_016E" + acs."B01001\_039E" + acs."B01001\_040E" AS age\_45\_54,

acs."B01001\_017E" + acs."B01001\_018E" + acs."B01001\_019E" + acs."B01001\_041E" + acs."B01001\_042E" + acs."B01001\_043E" AS age\_55\_64,

acs."B01001\_020E" + acs."B01001\_021E" + acs."B01001\_022E" + acs."B01001\_044E" + acs."B01001\_045E" + acs."B01001\_046E" AS age\_65\_74,

acs."B01001\_023E" + acs."B01001\_024E" + acs."B01001\_047E" + acs."B01001\_048E" AS age\_75\_84,

acs."B01001\_025E" + acs."B01001\_049E" AS age\_85\_up,

acs."B25002\_001E" AS hse\_units,

acs."B25002\_003E" AS vacant,

acs."B25014\_008E" AS renter\_occ,

acs."B25014\_005E" + acs."B25014\_006E" + acs."B25014\_007E" + acs."B25014\_011E" + acs."B25014\_012E" + acs."B25014\_013E" AS crowded,

acs."B25024\_002E" + acs."B25024\_003E" + acs."B25024\_004E" AS sfr,

acs."B25024\_007E" + acs."B25024\_008E" + acs."B25024\_009E" AS units\_10,

acs."B25024\_010E" AS mh,

acs."B25034\_006E" + acs."B25034\_007E" + acs."B25034\_008E" + acs."B25034\_009E" + acs."B25034\_010E" AS older,

acs."B19013\_001E" AS inc\_hh,

svi.r\_pl\_themes AS svi,

acs."B12001\_001" - (acs."B12001\_003" + acs."B12001\_012") AS married,

acs."B23025\_005" AS unemployed,

acs."B12001\_007" AS nilf,

sm.adult\_smoke AS smoke\_st,

sc.smoking\_pct AS smoke\_cty

FROM f

LEFT JOIN bg.tract\_years t ON f.year = t.year AND f.geoid = t.geoid::text

LEFT JOIN d ON t.year = d.year AND t.fc\_dept\_id = d.fd\_id

LEFT JOIN bg.svi2010 svi ON f.geoid = ('14000US'::text || svi.fips::text)

LEFT JOIN bg.acs\_est acs ON f.geoid = acs.geoid AND

CASE

WHEN f.year < 2008 THEN 2008

WHEN f.year > 2012 THEN 2012

ELSE f.year

END::double precision = (acs.year - 2::double precision)

LEFT JOIN bg.sins sm ON t.state::text = sm.postal\_code::text AND sm.year = 2010

LEFT JOIN bg.sins\_county sc ON "substring"(f.geoid, 8, 5) = sc.fips

**Appendix II**

The first script is the R script that I used to clean up the data and build the filters that are used.

> for( i in c( "geoid\_source", "region", "state", "fd\_size", "risk\_class" ) ) high.risk[[ i ]] <- factor( high.risk[[ i ]] )

> high.risk$hr\_floors[ high.risk$risk\_class != "High Rise" ] <- 0

> for( i in c( "deaths", "injuries" ) ) high.risk[[ i ]][ is.na( high.risk[[ i ]] ) ] <- 0

> high.risk$inc\_hh <- log( as.numeric( high.risk$inc\_hh ) )

> high.risk$region[ high.risk$state %in% c( "AK", "HI" ) ] <- "West"

> high.risk$region <- relevel( high.risk$region, "West" )

> high.risk$lcl <- high.risk$no.fire <- high.risk$include <- TRUE

> for( i in setdiff( names( high.risk ), c( "bld\_units", "eff\_yr" ) ) ) high.risk$include <- high.risk$include & ! is.na( high.risk[[ i ]] )

> high.risk$include <- high.risk$include & high.risk$fd\_size %in% paste( "size", 3:9, sep="\_" )

> high.risk$no.fire <- high.risk$size\_1 > 0

> abc <- high.risk[, c( "year", "fd\_id", "parcel\_id", "dept\_incidents" ) ]

> ddd <- unique( high.risk[, c( "year", "fd\_id", "dept\_incidents" ) ] )

> dept <- aggregate( ddd$dept\_incidents, list( fd\_id=ddd$fd\_id ), function( x ) c( mean( x, na.rm=TRUE ), sd( x, na.rm=TRUE ) ) )

> dept$m <- dept$x[,1]

> dept$sd <- dept$x[,2]

> dept$x <- NULL

> abc$m <- dept$m[ match( abc$fd\_id, dept$fd\_id ) ]

> abc$sd <- dept$sd[ match( abc$fd\_id, dept$fd\_id ) ]

> abc$lcl <- with( abc, m - 2 \* sd )

> abc$lcl.yn <- with( abc, dept\_incidents >= lcl )

> high.risk$lcl <- abc$lcl.yn

> high.risk$lcl[ is.na( high.risk$lcl ) ] <- TRUE

> rm( abc, ddd, dept, i )

> high.risk$sz2.pct <- with( high.risk, size\_2 / size\_1 )

> high.risk$sz3.pct <- with( high.risk, size\_3 / size\_2 )

> aaa <- data.frame( pcl=unique( high.risk$parcel\_id ) )

> set.seed( 213976749 )

> aaa$val <- floor( runif( nrow( aaa ) ) \* 3 )

> aaa$set <- c( "test", "training", "validation" )

> aaa$set[ aaa$val == 0 ] <- "training"

> aaa$set[ aaa$val == 1 ] <- "validation"

> aaa$set[ aaa$val == 2 ] <- "test"

> high.risk$set <- factor( aaa$set[ match( high.risk$parcel\_id, aaa$pcl ) ] )

> rm( aaa )

This is a slightly revised fn.test script used for the evaluation of the models. The only line that changed is marked.

fn.test <- function( input, output, subset=NULL )

{

# Test for errors:

# Test to see if the 'data' and dependent variables are all identical.

x <- unlist( lapply( input$models, function( x ) as.character( x$inputs$data ) ) )

dta <- x[1]

if( ! all( dta == x ) ) stop( "data are not all identical. Try breaking up the input and output files." )

x <- unlist( lapply( input$models, function( x ) as.character( x$inputs$formula[ 2 ] ) ) )

y <- x[1]

if( ! all( y == x ) ) stop( "Dependent variables are not all identical. Try breaking up the input and output files." )

rm( x )

# If a subset is not specified in the input to this function, use the first subset from the input file

if( is.null( subset ) )

{

x <- unlist( lapply( input$models, function( x ) as.character( x$inputs$subset ) ) )

if( ! all( x[1] == x ) ) simpleWarning( "The subsets are not all identical. Using the first. Try specifying the subset you want.")

rm( x )

subset <- input$models[[ 1 ]]$inputs$subset

}

# this allows me to extend a pre-existing test output object. I never use this option.

if( is.list( subset ) )

{

old.res <- subset

subset <- old.res$subset

results <- old.res$results

if( y != old.res$lhs ) stop( "When 'subset' is the old results list, then the dependent variables must match." )

}

# Now we generate a data frame with just the new (test) data.

new.data <- do.call( "subset", list( x=get( dta ), subset=substitute( a & set == "test", list( a=subset ) ) ) )

if( ! exists( "old.res" ) )

{

***results <- new.data[ , intersect( c( "year", "geoid", "state", "region", "fd\_id", "fd\_size", "parcel\_id" ), names( new.data ) ) ]***

results$dept.new <- as.character( NA )

if( y %in% names( new.data ) ) results[[ y ]] <- new.data[[ y ]]

else

{

yy <- eval( parse( text=y ), new.data )

y <- "y"

if( ncol( yy ) == 2 ) results[[ y ]] <- yy[ , 1] / ( yy[ , 1 ] + yy[ , 2 ] )

else results[[ y ]] <- yy

}

}

# 'vars' will be the list of names of the models analyzed.

vars <- NULL

for( k in names( input$models ) )

{

# OK, when will I ever have a NULL library??? What circumstance is this preparing for???

if( tolower( input$models[[k]]$fn["library"] ) == "null" ) next

# Make sure the proper library is loaded.

require( input$models[[k]]$fn["library"], character.only=TRUE )

# Initialize the variable in the results table and update the list of models

if( input$models[[k]]$fn["library"] == "glmnet" ){

results[[ paste( k, "min", sep="." ) ]] <- as.numeric( NA )

results[[ paste( k, "1se", sep="." ) ]] <- as.numeric( NA )

new.vars <- paste( k, c( "min", "1se"), sep="." )

} else {

results[[ k ]] <- as.numeric( NA )

new.vars <- k

}

vars <- c( vars, new.vars )

# This set generates the predictions. Each "run" is a separate prediction

for( i in names( input$runs ) )

{

if( is.list( input$runs[[i]] ) )

{

for( j in names( input$runs[[i]] ) )

{

# x is a logical vector showing the subset of new.data that this run applies to.

x <- eval( input$runs[[i]][[j]], envir=new.data )

# And in some cases that subset is empty, so skip those cases.

if( any( x ) & ! is.null( output[[k]][[i]][[j]]$model ) )

{

# An uncomfortably large number of routines require special handling to ensure they give answers.

# So, here I cycle through each of the libraries that need special handling and give it to them.

#

# GLMER

# There are two things that need attention here. First, I need to add the 'allow.new.levels' flag.

# Second, I want to record which records are associated with new levels. This section does that.

if( input$models[[k]]$fn["library"] == "lme4" )

{

results[[ k ]][x] <- predict(output[[k]][[i]][[j]]$model, newdata=new.data[x,], type="response", allow.new.levels=TRUE)

x1 <- results$fd\_id %in% row.names( ranef( output[[k]][[i]][[j]]$model )$fd\_id )

results$dept.new[ x & ! x1 ] <- paste( results$dept.new[ x & ! x1 ], k, sep=";" )

}

# LASSO / RIDGE

# The input format for glmnet is different, so I have to account for that.

# There are two different solutions to glmnet. This is designed to return both.

else if( input$models[[k]]$fn["library"] == "glmnet" )

{

new.x <- model.matrix( input$models[[k]]$inputs$formula, new.data[x,], na.action=na.pass )

if( "offset" %in% names( input$models[[k]]$inputs ) ) {

off <- eval( input$models[[k]]$inputs$offset, new.data[x,] )

results[[ new.vars[1] ]][x] <- predict( output[[k]][[i]][[j]]$model, newx=new.x, type="response", s="lambda.min", offset=off )

results[[ new.vars[2] ]][x] <- predict( output[[k]][[i]][[j]]$model, newx=new.x, type="response", s="lambda.1se", offset=off )

} else {

results[[ new.vars[1] ]][x] <- predict( output[[k]][[i]][[j]]$model, newx=new.x, type="response", s="lambda.min" )

results[[ new.vars[2] ]][x] <- predict( output[[k]][[i]][[j]]$model, newx=new.x, type="response", s="lambda.1se" )

}

}

# Ranger (Random Forest implementation)

# Right now, the only special item here is verbose=FALSE, and the name of the newdata set. It also returns a structure, and I just want the prediction

else if( input$models[[k]]$fn["library"] == "ranger" )

{

results[[ k ]][x] <- predict( output[[k]][[i]][[j]]$model, data=new.data[x,], verbose=FALSE )$predictions

}

# Everything else

else

{

results[[ k ]][x] <- predict( output[[k]][[i]][[j]]$model, newdata=new.data[x,], type="response" )

}

}

}

}

else

{

x <- eval( input$runs[[i]], envir=new.data )

if( any( x ) & ! is.null( output[[k]][[i]]$model ) )

{

# GLMER

if( input$models[[k]]$fn["library"] == "lme4" )

{

results[[ k ]][x] <- predict( output[[k]][[i]]$model, newdata=new.data[x,], type="response", allow.new.levels=TRUE )

x1 <- results$fd\_id %in% row.names( ranef( output[[k]][[i]]$model )$fd\_id )

results$dept.new[ x & ! x1 ] <- paste( results$dept.new[ x & ! x1 ], k, sep=";" )

}

# LASSO / RIDGE

else if( input$models[[k]]$fn["library"] == "glmnet" )

{

new.x <- model.matrix( input$models[[k]]$inputs$formula, new.data[x,], na.action=na.pass )

if( "offset" %in% names( input$models[[k]]$inputs ) ) {

off <- eval( input$models[[k]]$inputs$offset, new.data[x,] )

results[[ new.vars[1] ]][x] <- predict(output[[k]][[i]]$model, newx=new.x, type="response", s="lambda.min", offset=off)

results[[ new.vars[2] ]][x] <- predict(output[[k]][[i]]$model, newx=new.x, type="response", s="lambda.1se", offset=off)

} else {

results[[ new.vars[1] ]][x] <- predict( output[[k]][[i]]$model, newx=new.x, type="response", s="lambda.min" )

results[[ new.vars[2] ]][x] <- predict( output[[k]][[i]]$model, newx=new.x, type="response", s="lambda.1se" )

}

}

# Ranger (Random Forest implementation)

else if( input$models[[k]]$fn["library"] == "ranger" )

{

results[[ k ]][x] <- predict( output[[k]][[i]]$model, data=new.data[x,], verbose=FALSE )$predictions

}

# Everything else

else

{

results[[ k ]][x] <- predict( output[[k]][[i]]$model, newdata=new.data[x,], type="response" )

}

}

}

}

}

results$dept.new <- sub( "^NA;", "", results$dept.new )

# results$dept.new[ is.na( results$dept.new ) ] <- ""

s <- results[ , vars ]

s <- ( s - results[[ y ]] ) ^ 2

if( is.null( ncol( s ) ) ) se <- sqrt( mean( s, na.rm=TRUE ) )

else se <- sqrt( colMeans( s, na.rm=TRUE ) )

if( exists( "old.res" ) ) list( lhs=y, subset=subset, se=c( old.res$se, se ), results=results )

else list( lhs=y, subset=subset, se=se, results=results )

}