UTK Alumni Donations: Predicting What Alumnus Will Donate

Executive Summary

To support the University of Tennessee's Development Office in better identifying potential alumni donors, our team analyzed 30,000 alumni records from UT's database to predict whether an alumnus donated in 2024. Using a random forest model, we achieved a predictive accuracy of approximately 94% and an AUC of 0.95. This significantly outperformed the naive "majority rule" model (which assumes no one donates), which only achieved around 70% accuracy.

Main Goal and Questions Addressed:

- Can we predict who is likely to donate in 2025 based on prior behavior?
- What are the key drivers behind giving behavior?
- Is the third-party information UT pays for (e.g., income/wealth estimates) actually helpful?

Key Findings and Recommendations:

- **Best predictors of donating:**

  Past donation history (NumYearsDonate), attendance at UT sports events (TotalGames), LifetimeCashGiftCategory, and whether the alumnus has supported Athletics.

- **Third-party data worth keeping:**

  Estimated Gift Capacity, Annuity Likelihood, and Bequest Likelihood slightly improved model accuracy. When removed, model accuracy decreased from 94.3 to 94 percent, indicating that UT might want to decide if it is worth paying for this information.

- **Target these alumni in 2025:**
  - Those who have donated before, especially multiple years
  - Those who attended 6+ sports games (especially 50+)
  - Alumni who gave a lifetime gift over $5K
  - Athletics donors
  - Alumnus with multiple family members connected to UT

Model Building Process:

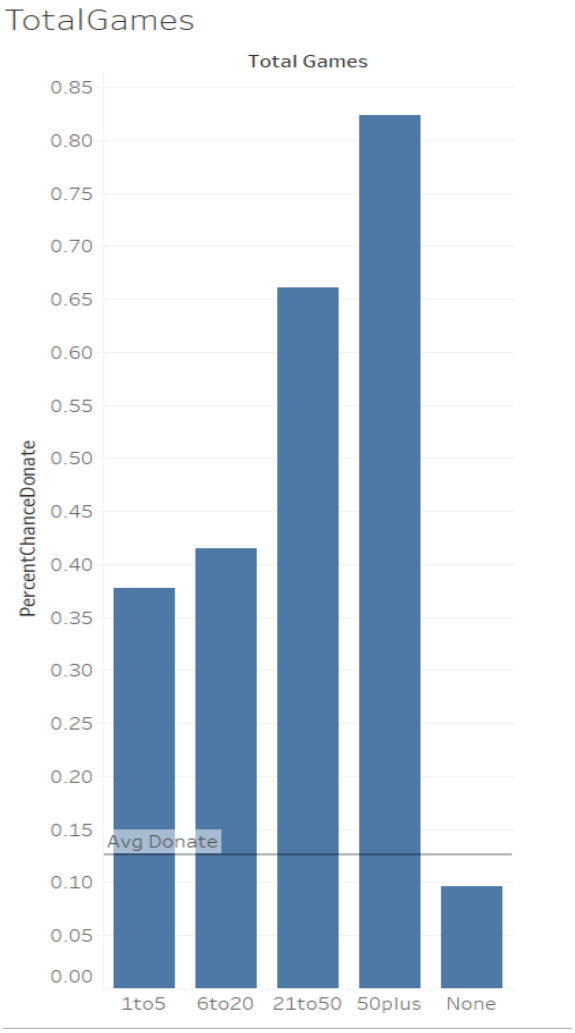
We used the DONATED dataset that tracks different characteristics from the UTK alumni database, removed non-informative columns such as ID, and trained a random forest model using historical engagement, demographic, and gift-related variables. We evaluated the model using a 70/30 train-test split. In addition, we compared performance with and without third-party variables (e.g., EstIncome, CRTLikelihood) to assess their added value. The overall average predicted donation rate in 2024 was 12.6%, serving as a helpful benchmark for interpreting group-level results in the visualizations.

Further Recommendations:

The Development Office should target repeat donors and highly engaged alumni, especially those active in athletics or with prior large gifts. Third-party estimates offer real value and are worth retaining. Further enhancements could come from tracking major life events, graduation honors, or social media engagement.

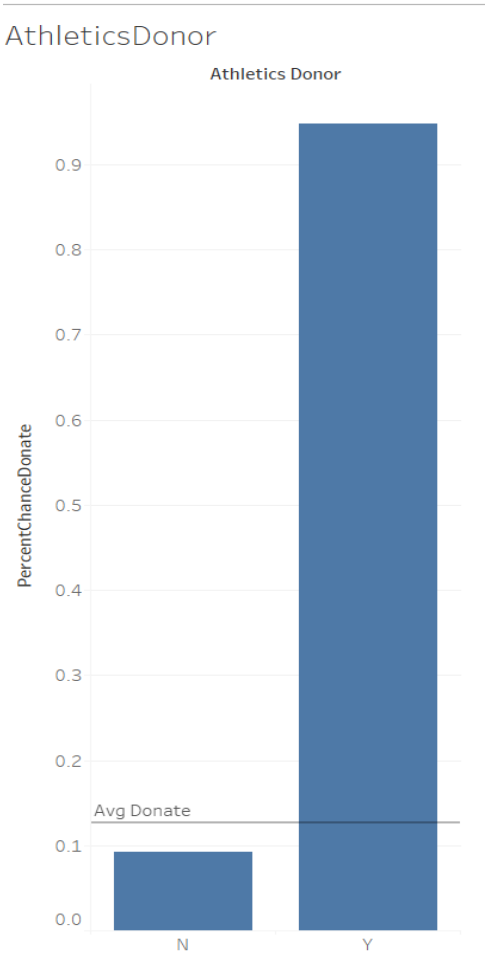
Discussion of Findings:

Total Games Attended vs. Donation Likelihood



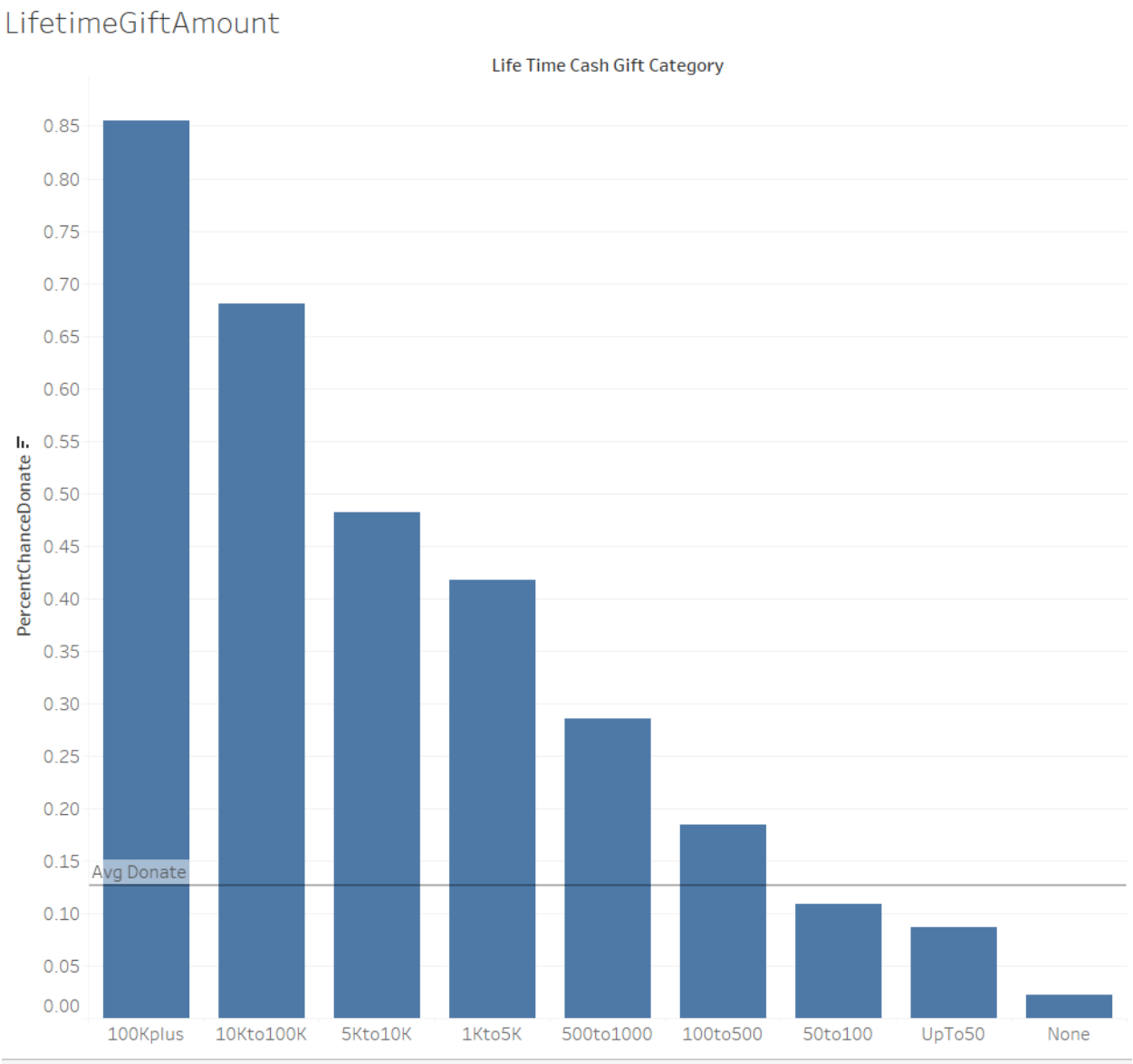
This bar chart shows a strong positive relationship between the number of UT sports games an alumnus attended and their likelihood of donating in 2024. Alumni who attended 50+ games had an average donation probability exceeding 80%, far above the 12.6% overall average (indicated by the reference line). Even moderate engagement—such as attending 6 to 20 games—correlated with a donation rate of over 40%. In contrast, alumni who never attended a game donated at a rate below 10%. This highlights sports engagement as a powerful predictor and suggests the Development Office should prioritize outreach to game-attending alumni, especially those with higher attendance levels.

Athletics Donor Status vs. Donation Likelihood



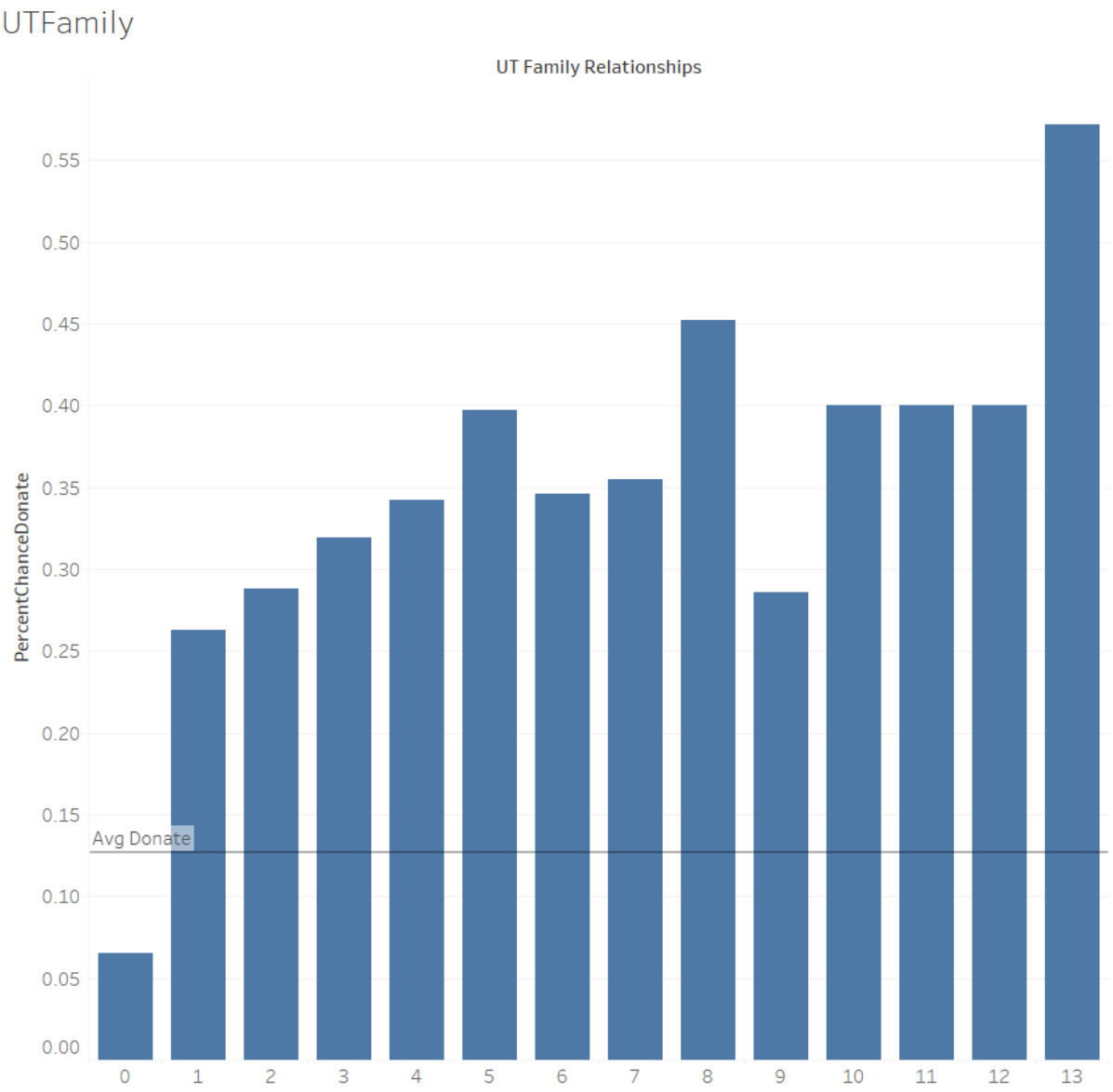
This chart demonstrates a striking contrast between alumni who have previously donated to athletics and those who have not. Alumni who earmarked gifts for the athletics department had an average 2024 donation probability exceeding 95%, compared to under 10% for non-athletics donors. This massive gap—nearly tenfold—makes Athletics Donor one of the strongest categorical predictors in the model. Given this clear differentiation, the Development Office should treat past athletics donors as top-priority contacts for future campaigns.

Lifetime Gift Amount vs. 2024 Donation Likelihood



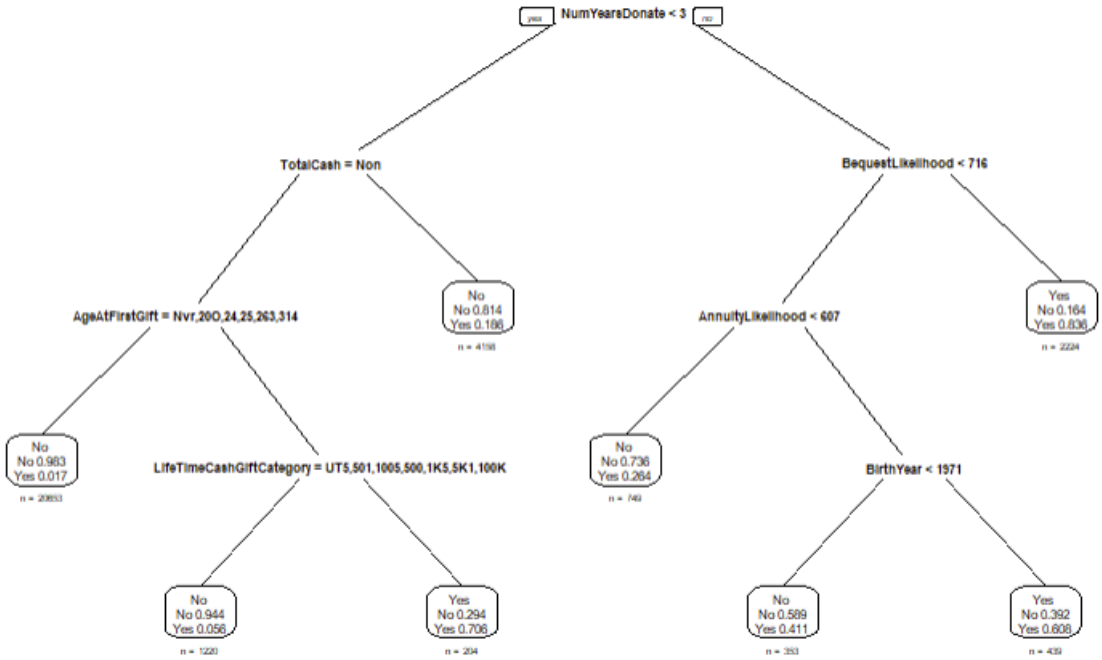
This chart shows a strong, positive relationship between historical donation size and likelihood of giving again. Alumni who had previously donated $100K or more had an average 2024 donation probability of around 85%, while those who had given nothing had virtually no chance of donating. Each increase in gift category corresponds with a consistent rise in donation likelihood, confirming LifetimeCashGiftCategory as one of the most influential drivers in the model. This trend highlights the importance of retaining and engaging high-dollar donors, as their giving history makes them the most reliable targets for future campaigns.

UT Family Relationships vs. 2024 Donation Likelihood



This chart reveals a positive trend between the number of UT family relationships and the probability of donating in 2024. Alumni with no family ties to the university had a donation probability below 10%, while those with multiple family members who also attended UT had a much higher likelihood—exceeding 50% for those with 13 relatives. This suggests that strong familial ties to the university foster a greater sense of loyalty and long-term engagement. Targeting legacy families with personalized outreach could be an effective strategy for boosting future donations.

Decision Tree: Key Combinations That Predict Giving



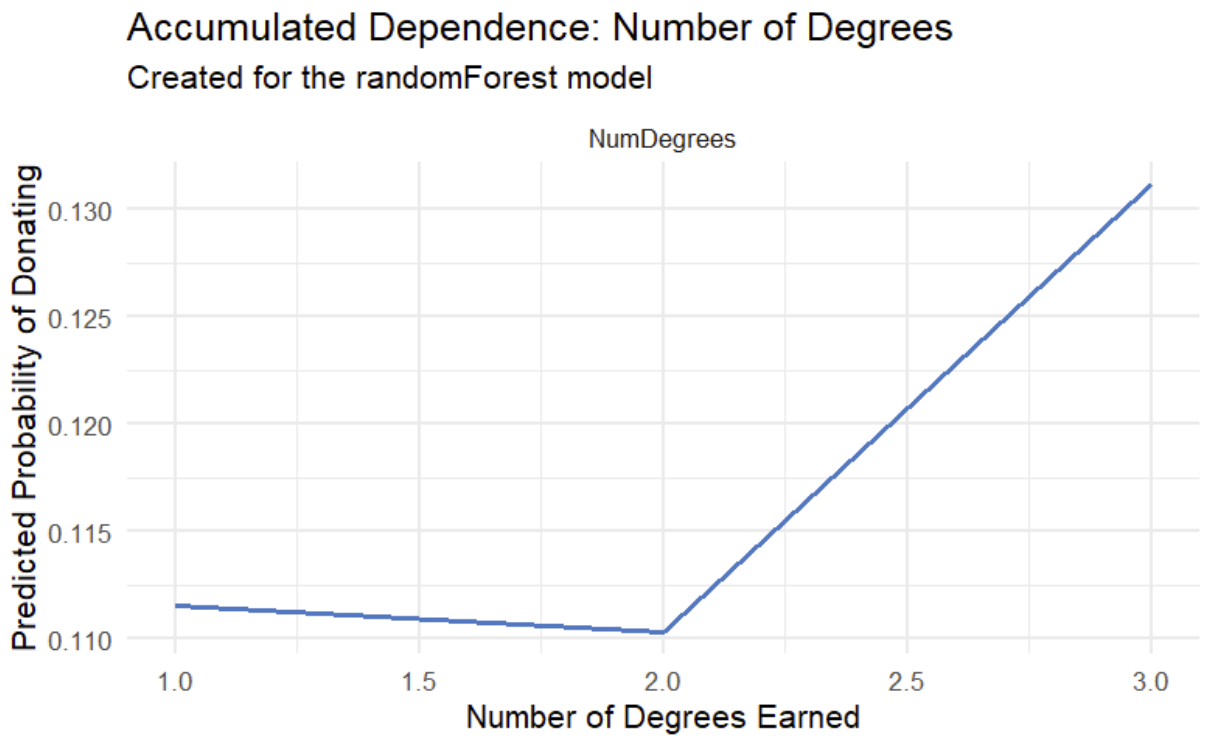
This simple decision tree model highlights several key combinations of factors that distinguish likely donors from non-donors. The most important initial split is whether an alumnus has donated in at least three previous years (NumYearsDonate ≥ 3). Alumni with a history of giving are far more likely to donate again.

Among those without such a history, donation likelihood is especially low for individuals with no recorded cash gifts (TotalCash = None) and younger donors (AgeAtFirstGift values associated with very recent graduation). In contrast, even among low-history donors, the probability of giving increases if they have previously given at least a moderate amount (LifeTimeCashGiftCategory includes $1K–$100K).

For those with prior donation history, third-party variables play a greater role: high BequestLikelihood, AnnuityLikelihood, and older BirthYear (i.e., pre-1971) were all associated with increased donation probability. This reinforces the value of third-party wealth indicators when paired with donation history and age.

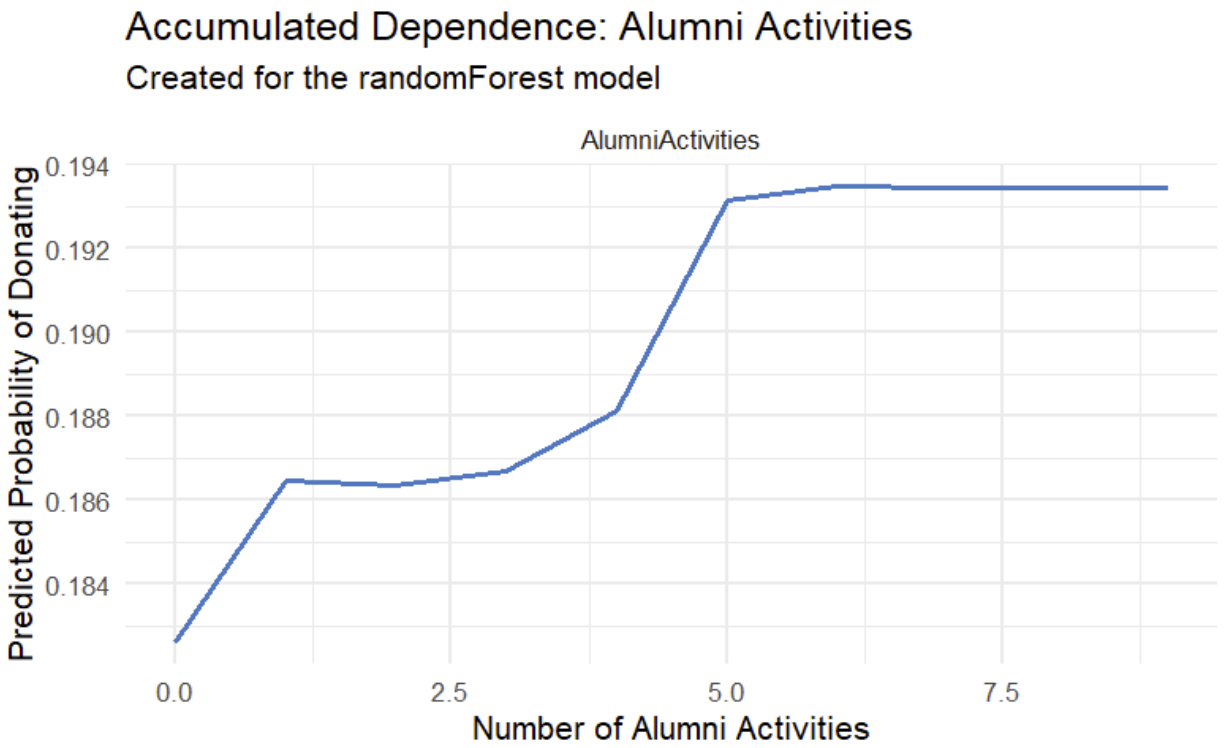
This tree makes clear that sustained prior giving remains the strongest signal, but certain wealth signals and life stage indicators can help flag lower-engaged alumni who are still worth pursuing.

Partial Dependence: Number of Degrees



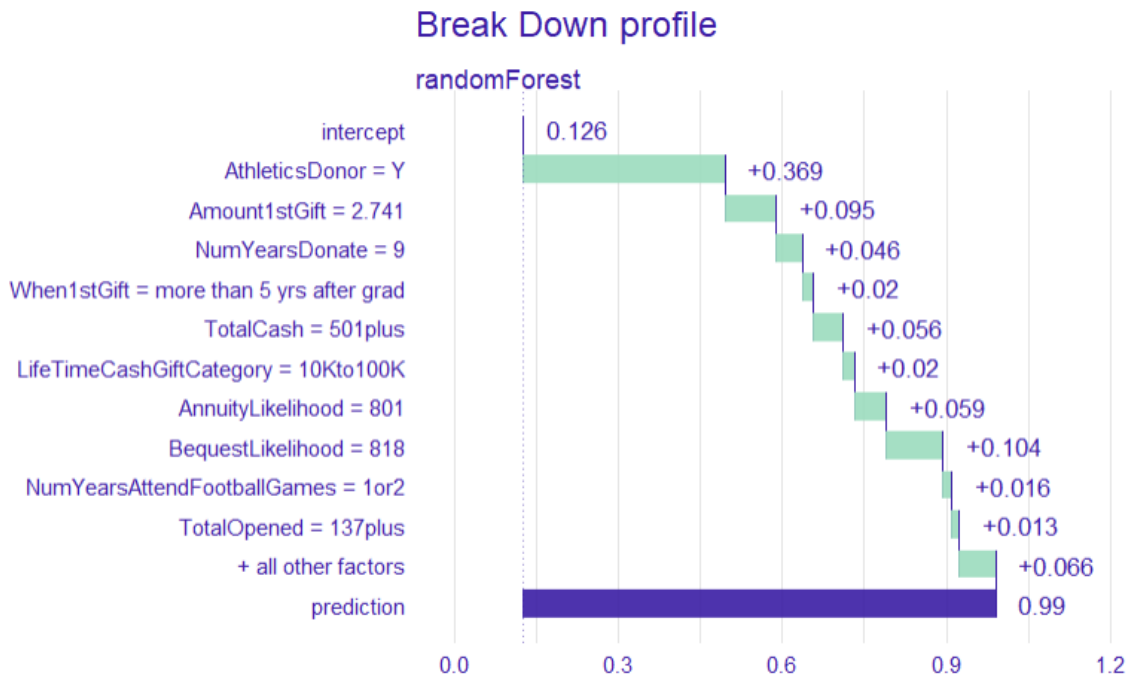
This accumulated dependence plot shows that alumni who hold more degrees from UT are slightly more likely to donate in 2024. The probability remains flat for those with one or two degrees, but a noticeable increase occurs for those with three degrees, pushing predicted donation probability above 13%. This trend supports the idea that deeper academic ties to the university—reflected by multiple degrees—correlate with increased likelihood of giving.

Accumulated Dependence: Alumni Activities



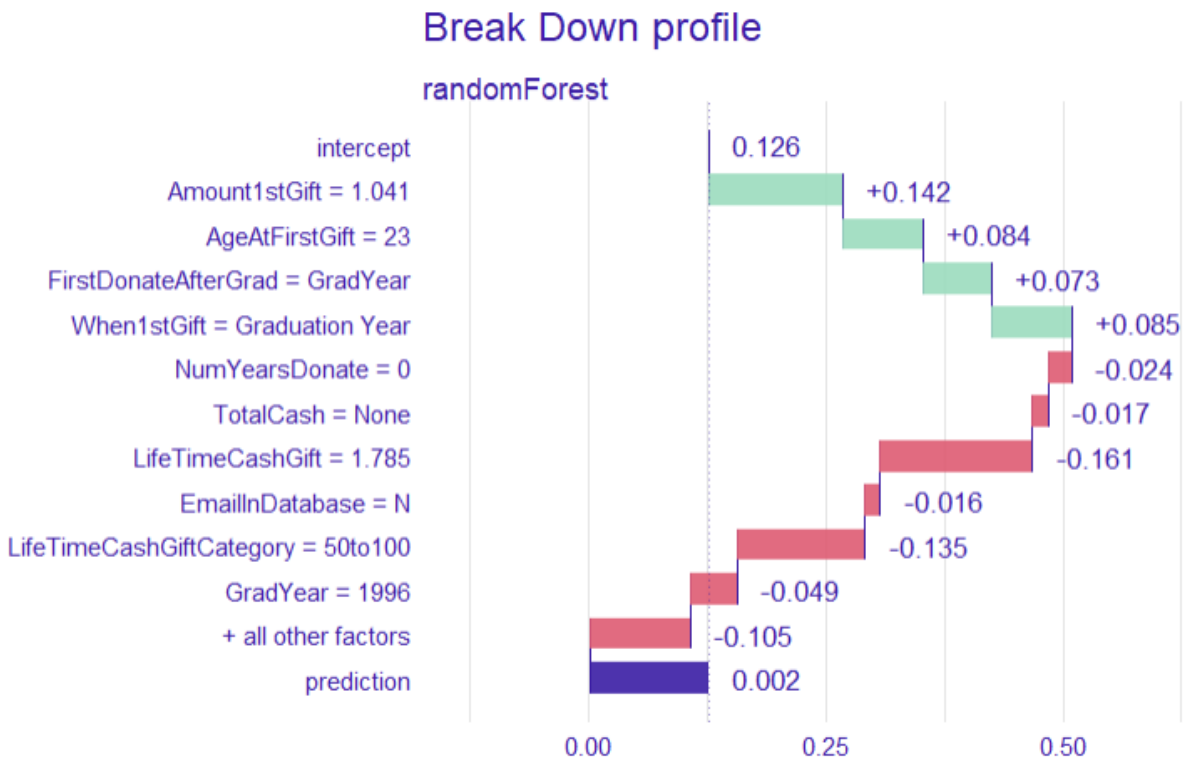
This plot illustrates the relationship between the number of alumni activities an individual participated in and their predicted probability of donating in 2024. We observe a consistent upward trend: alumni with higher levels of past engagement in UT activities are more likely to donate. Specifically, the predicted donation probability rises notably from 0 to 5 activities, then begins to plateau, suggesting diminishing returns beyond that point. This pattern reinforces the idea that fostering alumni involvement through events and programs can significantly boost future giving behavior.

DALEX Breakdown: High Probability Donor (Predicted: 99%)



This breakdown plot visualizes why the model predicted an extremely high probability (99%) of donating in 2024 for this individual alumnus. The strongest positive driver was being an Athletics Donor, which alone added +0.369 to the base prediction. Additional key contributors included a high first gift amount, nine prior donation years, and significant engagement indicators such as attending football games, having opened 137+ emails, and a lifetime giving category of $10K–$100K. Third-party variables like AnnuityLikelihood (801) and BequestLikelihood (818) also played a positive role. These results reinforce that sustained giving behavior, high-value donations, and athletic affinity are powerful predictors of future donations.

DALEX Breakdown: Low Probability Donor (Predicted: 0.2%)



This breakdown plot illustrates why the model predicted a very low likelihood (0.2%) that this alumnus would donate in 2024. Although there were some small positive influences—such as a modest first gift and a young age at first gift—the overwhelming negative drivers included having no prior donation years, no total cash contributed, and a low lifetime gift category ($50–$100). The alumnus also had no email on file, which likely reduced contact effectiveness. Additionally, they graduated in 1996, which historically shows lower donation likelihood than older cohorts. These factors combined to drag the predicted probability near zero, identifying this alumnus as a low-priority target for future outreach.