It Would Be Beneficial to Supplement Grade Point Average with Grade Point Standard Deviation

Olga Kosheleva[1] and Vladik Kreinovich[2]

[1]Department of Teacher Education

[2]Department of Computer Science

University of Texas at El Paso

El Paso, Texas 79968

olgak@utep.edu, vladik@utep.edu

At Present, Only Grade Point Average Is Used

- It is often important to evaluate and compare graduates:
  - when a company makes a decision on hiring a former student
  - when a graduate program makes a decision on whether to accept a student.
- At present, only one type of statistical characteristic is used for this evaluation and comparison: the (GPA).
- In statistical terms, GPA is the mean of the student's grades.
- Specifically, the information usually consists of:
  - the overall GPA and
  - the GPA in major.

Need to Go Beyond GPA

- The GPA does not provide a full information about the student. For example, an average B grade:
  - may mean that a student has a steadily good performance in all his/her classes, or
  - that a student is barely passing some classes with C- while showing brilliance and A+ in others.
- Hiring the first, low-variance student leads to no risk and medium rewards.
- Hiring the second, high-variance student comes with a risk:
  - in some tasks, he/she will be great,
  - in other tasks he/she may be a disaster.
- A company (or a graduate school) would benefit from knowing the difference.

How to Gauge the Difference: Experience of Financial Analysis

- How can we gauge the difference?
- A similar problem occurs when people make a decision on financial investments.
- When people select stocks and/or bonds for their portfolio, they take into account:
  - not only the mean performance of the corresponding instruments,
  - but also their *standard deviation* – a measure of their deviation from the mean.
- It is thus desirable to supplement the GPA with the Grade Point Standard Deviation (GPSD).

How To Compute Grade Point Standard Deviation (GPSD): Seemingly Natural Idea and Its Limitations

- In principle, we can compute GPSD based on the grades for different classes.
- Specifically, if $g_1, \ldots, g_n$ are grade for different class, then $\text{GRA} = \dfrac{1}{n} \cdot \sum\limits_{i=1}^{n} g_i$ and

$$\text{GPSD} = \sqrt{\frac{1}{n} \cdot \sum_{i=1}^{n} (g_i - \text{GPA})^2}.$$

- However, it is important to take into account that
  - each grade g_i
  - is itself an average of grades for different tests and assignments.

How To Compute Grade Point Standard Deviation (GPSD): A More Adequate Idea

- Using the natural-idea formula will underestimate the standard deviation.
- A more adequate description requires that:
  - for each class (and maybe for each test),
  - we provide not only the usual (average) grade g_i,
  - but also the standard deviation σ_i of the corresponding grades.
- Based on these variances, we can estimates the overall GPSD as

$$\text{GPSD} = \sqrt{\frac{1}{n} \cdot \sum_{i=1}^{n} [(g_i - \text{GPA})^2 + \sigma_i^2]}.$$

A Similar Idea Can Be Used In Evaluating Faculty

- A similar idea can be used in evaluating faculty:
  - when hiring a new faculty,
  - during annual evaluations,
  - during tenure and promotion process.
- Usually, we consider average numbers per year, average student evaluations.
- In addition, we can consider standard deviations.
- This will enable us to distinguish between, e.g.,,
  - a consistently good researcher and
  - a researcher whose outputs alternate between dry spells and brilliant outbursts.

Conclusions

- A "B"-level GPA:
  - may mean a steadily good performance, or
  - it may mean that a student is barely passing some classes while showing brilliance in others.
- Hiring the low-variance student leads to no risk and medium rewards.
- Hiring the high-variance student comes with a risk.
- A company (or a graduate school) would benefit from knowing the difference.
- It is therefore desirable to supplement the GPA with the Grade Point Standard Deviation (GPSD)– based on variance for each course.

Acknowledgments

This work was supported in part by the National Science Foundation grants:

- HRD-0734825 and HRD-1242122 (Cyber-ShARE Center of Excellence), and
- DUE-0926721.