Weekly Paper Summary (25 points total)

Paper Title	Functional Linear Regression with Mixed Predictors
Authors	Daren Wang, Zifeng Zhao, Yi Yu, Rebecca Willett
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1. **What do you think the paper is about in layman's terms? What did the research focus on, what did the authors find and what are the main conclusions (if any) [5 points]**

In contrast to standard linear regression, which uses non-functional predictors, functional linear regression uses predictors that are functions of another variable such as time. Some data sets may have both non-functional and functional predictors, which can't be used in the same regression model as they are. The authors propose a method for mapping predictors to a higher dimensional space using a Reproducing Kernel Hilbert Space, which can incorporate both functional and non-functional predictors. They use a combination of penalty terms to regularize these high dimensional points so they don't get too many irrelevant nonzero coefficients and overfit the data. Ultimately, their methods produce lower values in the error metrics they used than other methods for dealing with mixed type parameters.

2. **How would you extend the research paper – what new area(s) would you focus the paper on? [5 points]**

This research paper could be extended by dealing with nonlinear relationships between predictors. The assumption that predictors are linearly related is often incorrect and is especially likely to be incorrect if there are many predictors. It could also be extended by using more types of functional data.

3. **Discuss at least two real-world applications (not mentioned in the paper) that would benefit from the focus of / applications mentioned in the paper and why [15 points]**

   One real world application of this research is in finance. Financial datasets may include predictors as a function of time such as stock prices or interest rates and predictors that aren't functional such as industry type, location, and date founded. Another real world application is for gene expression data. The level of expression of genes is a function of time, but other non-functional predictors such as age, prior conditions, and relevant bio-indicators may also be useful for predicting disease risk or treatment.