

A Machine Learning Approach for Predicting Children's Future BMI Yousef Yasin*, Yuan Hong Sun, and Kang Lee Department of Applied Psychology and Human Development, University of Toronto

BACKGROUND

- Children's future body mass index (BMI) is a major concern for parents and physicians due to the current pediatric obesity epidemic.
- Can we use machine learning techniques to predict \bullet children's future BMI?

METHODS

• Children's BMI were collected at two time points from Chinese hospitals between 1989 and 2010 (n = 5662). The age of children ranged from 0 to 17 years.

		Curre	nt Mean	Future Mean	
Age		6.51 ± 5.19		16.71 ± 5.3	
BMI (kg/m ²)		16.71	± 2.31	18.93 ± 3.18	
			-		
Sex	n				
Male	3	140			
Female	2	522			

- We applied seven different machine learning regression techniques to train separate models to predict a child's future BMI.
- The models were trained and tested on 80% of our data (n = 4530).
- The accuracy of models were then evaluated using the remaining 20% of our data (n = 1132).



Model Performance : (MAE) Error Absolute] Mean. MLP NN Random Bayesian Support Linear Bagging Vector Ridge Forest Regressor Regression Machine

Figure 1: Mean absolute error for BMI (kg/m²) for each machine learning model. Lowe represent improved model performance.

Model Type



Figure 3: (Left) Questionnaire page of the website to enter the current age, height, weight, BMI and Figure 2: The bar chart represents mean SHAP values (SHapley Additive exPlanations) for each sex of children. (Right) Results page showing generated results from the implemented models, variable corresponding to the importance in predicting future BMI of children. predicting the child's height, weight and BMI.

DISCUSSION

- Support Vector Machine and Multilayer Perceptron (MLP) performed the best in predicting a child's future BMI (Figure 1).
- Weight, BMI and age to predict were the most important factors for predicting BMI in children based on SHAP values (Figures 2).
- We implemented the machine learning models into a website to be filled out by clinicians and parents to make predictions (Figure 3).

RESULTS

■ BMI	Child Height and Weight Prediction	Child Height Predic
Ī	Please fill in the following entries for your child. This	
	tool is only accurate if your child is of typical (5th-95th percentile) size.	
_		Predicted heig
		Predicted weig
	6/6	Predicted BMI:
	Gender	
	Male	
	O Female	Try ag
KGBoost		
	Your age	Edit ans
	9	
	Your Height(cm)	Submit to
er MAE	131	
		Summary of vo
	Your Weight(kg)	Summary or ye
	28	Gender
+1.05		
	BMI (kg/m^2)	Your age
	16.3	Your Height(cm)
	Age to Predict	Tour meight(em)
	16	Your Weight(kg)
		BMI (kg/m^2)
	Submit	Age to Predict
	Cancel	

Feel free to use our tool to predict a child's future BMI.

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and Weight ction ht: 165.0 cm ight: **54.0 kg** 19.9 kg/m^2 vers Anura our answers: Male 131 28 16.3 16