| **Slide** | **Script** |
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|  | Hello everybody I hope your all having a great day  My name is Savar Toteja. Im a student at Metuchen high school in New Jersey  And this is a project titled…  Leveraging Machine Learning to Identify Effective Teaching Strategies for Children with Autism Spectrum Disorder |
| 2 | So if I had to describe this project in one long, long sentence:  This study evaluates the use of machine learning algorithms to identify personalized teaching methods for children with ASD and develops a model for educators to implement more efficient and inclusive educational strategies tailored for individual students. |
| 3 | Why this project?  Children with autism encounter a range of educational challenges that can significantly impede their learning and development. These challenges include difficulties with communication, social interaction, and repetitive behaviors, which can affect their ability to engage with traditional teaching methods. Addressing these challenges requires specialized, individualized teaching strategies that cater to their unique needs and strengths.  My personal motive for this project comes from my volunteer work, teaching children with special needs how to play sports. After seeing their circumstances and isolated education from others, I was inspired to do something to help. And I thought, what better way to do that, then with machine learning. |
| 4 | So, like the students here, my solution was an AI model. An AI model offers significant advantages over traditional, time-consuming, and costly consultations with specialists. It quickly analyzes a child's needs through a simple 10-question questionnaire, providing immediate, personalized recommendations crucial for early intervention in ASD. This cost-effective approach can be used repeatedly, making it accessible for more families. Additionally, AI-driven recommendations are consistent and objective, relying on data and patterns rather than subjective human evaluations. This ensures a standardized approach, leading to more reliable and effective educational outcomes. |
| 5 | Google Collab was utilized for the coding in this study. The programming language used was Python. For sourcing the datasets, we utilized Kaggle and GitHub. |
| 6 | Four datasets were combined for this study. "Autistic Spectrum Disorder Screening Data for Toddlers," "Behavior Analysis of Autism." and two versions of "Autism Screening Child" dataset were used. The survey focused on toddlers under 3 years of age, where parents answered 10 yes-or-no questions regarding their child's behavior, forming 10 features named A1-A10. The remaining seven features were collected from the ASDTests screening app. Due to the insufficiency and general nature of individual datasets concerning clinical or screening autism spectrum disorder, all datasets were combined into a single uniform dataset. The final dataset contained 3043 samples with 17 features. |
| 7 | By leveraging machine learning algorithms, we were able to discern patterns and correlations in the data, which informed personalized educational plans tailored to the unique needs and strengths of each child. 4 different AI models were trained on the comprehensive dataset. These 4 were KNN, Decision Tree, Random Forest, and MLP |
| 8 | KNN was trained with k values ranging from 1 to 20 to find the optimal number of neighbors for classification.  As shown in the left figure, the k-nearest neighbors (KNN) model's performance varied with different k values, peaking at 80.625\% accuracy with k=9. |
| 9 | The Decision Tree model was trained with max depth values ranging from 1 to 7 to optimize its performance. It peaked at a max depth of 7 as well. |
| 10 | RF was tuned with two hyper-parameters: max depth (1 to 7) and the number of trees (10 to 100).  The Random Forest model's performance, peaked at a max depth of 7 and 50 trees. |
| 11 | MLP performance was evaluated across various learning rates and training epochs. The highest accuracy (over 98\%) was observed at learning rates of 0.01 and 0.05. |
| 12 | In the end here were our peak results. In training KNN achieved an accuracy rate of 80.62, DT 94.37, RF 94.92, and MLP 99.29. In testing, KNN achieved 81.62, DT 96.88, RF 95.01, and MLP a perfect 100%. |
| 13 | While my biggest learning experience was that creating an AI was not as easy as it looked in movies. We had 3 more nuanced learnings. First, the importance of data quality: the success of machine learning models depends heavily on the quality, completeness, and relevance of the data. We learned that data preprocessing is essential for accurate and reliable outcomes. Second, adaptability: our AI-driven approach demonstrated the potential for highly personalized education strategies. By analyzing individual questionnaire responses, the models could tailor educational methods to each child’s specific needs. Finally, model performance variability: different machine learning models showed varying performance levels. The Multi-Layer Perceptron (MLP) model achieved perfect testing accuracy, while models like KNN and Decision Tree provided valuable insights, underscoring the importance of model selection and tuning for optimal results. |
| 14 | Although this section could take about 4 days to get through, here are 3 challenges we faced.  First, gathering comprehensive datasets for ASD screening was difficult due to varying formats and quality. We solved this by sourcing data from Kaggle and GitHub and implementing rigorous preprocessing techniques. Second, selecting and tuning machine learning models required much testing. This was solved by extensively experimenting with MLP, Decision Trees, Random Forest, and KNN. Lastly, translating machine learning outputs into reviewable and easily understandable results was a difficulty. We addressed this by using visualization techniques, such as confusion matrices and learning curves, to clarify model performance and practical applications. |
| 15 | In our future endeavors, we aim to expand our testing to include more algorithms, enhancing our ability to find optimal solutions. We're committed to continually improving and updating our datasets to ensure accuracy and relevance. Importantly, we plan to integrate feedback from educators, parents, and caregivers, ensuring our interventions adapt effectively to real-world conditions. Together, we're advancing towards more effective and personalized educational support for children with Autism Spectrum Disorder. |