Name: Saima Sano

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Professor: Anna Devarakonda

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**Comparative Analysis Between NumPy and JAX**

**Introduction:**

This comprehensive report discusses two very powerful and widely used Python libraries for numerical computing applications: NumPy and JAX. These two excellent tools are foundational and pivotal to many areas such as scientific computing, machine learning, and deep learning pipelines, making them essential among researchers and developers.  
  
**Description:**

**NumPy, or Numerical Python,** is a fundamental and core library developed in the year 2006. It is widely utilized for a variety of operations on arrays, linear algebra, and basic numerical computations. The powerful library provides users with efficient multi-dimensional array management, the ability of broadcasting, and is supported by an extensive scientific ecosystem of tools developed atop it. This scientific ecosystem includes major libraries such as SciPy, Pandas, and scikit-learn, among others. Due to its simplicity, maturity, and the large amount of documentation available out there, NumPy is deemed a great choice to be used for general-purpose numerical programming tasks.  
  
**JAX**, which was initially developed by Google Research in the year 2018, greatly enhances the capabilities of the NumPy API by adding several sophisticated features such as automatic differentiation, also referred to as autograd, GPU and TPU acceleration, as well as just-in-time compilation via the implementation of XLA. This elegant library is especially well-suited to carrying out research within the domain of machine learning, primarily due to its superb capacity for differentiating through complex and sophisticated functions with remarkable efficiency in scaling computations through different types of accelerators. Additionally, JAX allows one to write code like NumPy, yet all the while have the convenience of performance optimizations along with a multitude of sophisticated features such as JIT for just-in-time compilation, GRAD for gradient calculation, vMap for vectorized mapping, and pMap for parallel mapping.  
  
**Comparison:**

While both libraries implement similar APIs, JAX is faster and more scalable than NumPy, especially on GPUs/TPUs. However, NumPy is more mature and simpler to use for typical numerical computing and data analysis workloads.  
  
**Applications:**

NumPy is heavily used in data analysis and scientific research and has proved to be an important library for researchers and analysts. On the other hand, JAX is at the forefront of driving groundbreaking developments in machine learning research and is a main contributor to areas such as reinforcement learning and neural network optimization.

**Conclusion:**

In conclusion, both libraries are significant and essential in their respective domains. NumPy is a trustworthy standard that has been utilized and embraced over the years, whereas JAX is a high-performance alternative that has been specifically designed to address the needs and specifications of the future in artificial intelligence and deep learning technologies.