CHIST-ERA Projects Seminar 2021
Analog Computing for Artificial Intelligence (ACAI)

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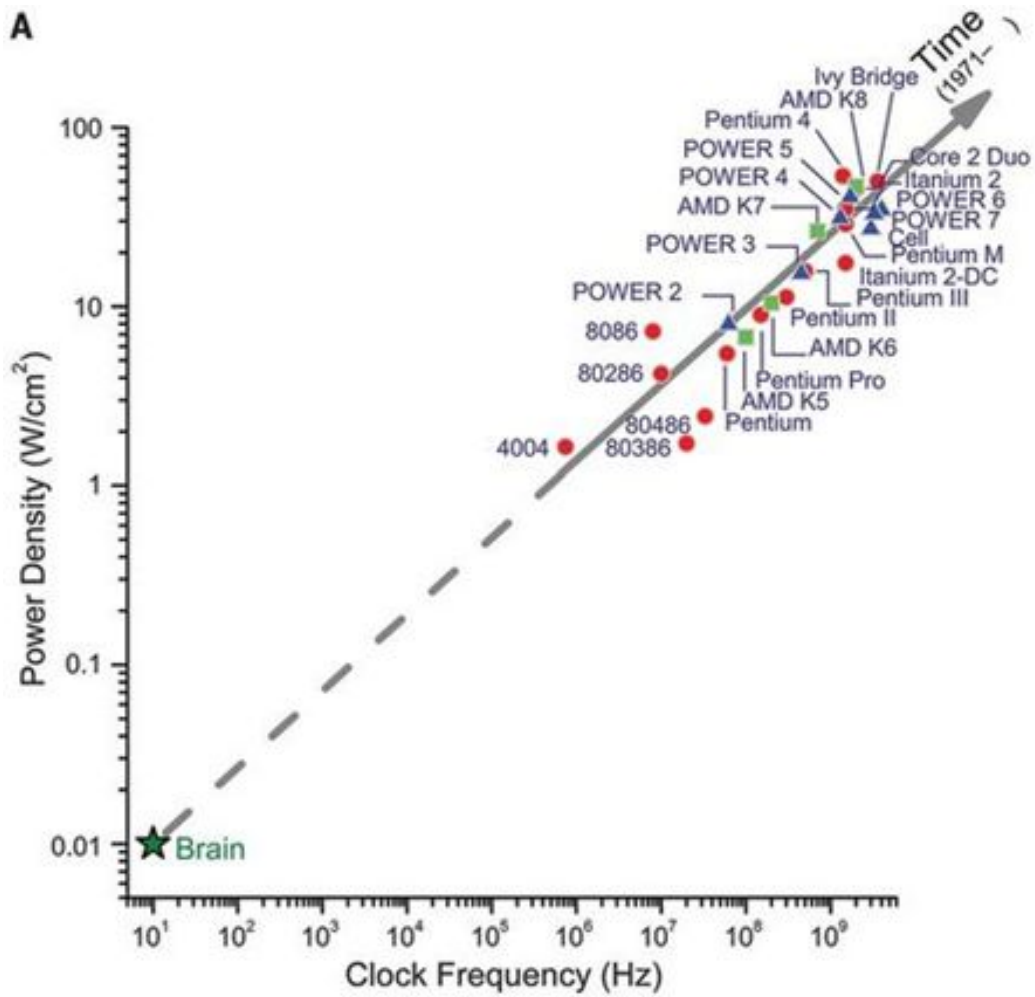
Introduction: The Context

ACAI - Analog Computing for Artificial Intelligence

- **Motivation**
  - ✔ Huge success of deep learning since almost 20 years…
    - **Annotated data, computing resources**
  - ✔ … which comes with a huge energy consumption
- **Increasing demand in machine learning**
  - ✔ Scaling, data hungriness, energy consumption for computing / cooling
- **The world around us is analog!**
- **End of Moore Law, limitations of digital Von Neumann**
- **Need for a new paradigm for the next decades!**
- **Inspiration from biology**

Introduction: The Context



Introduction: The Projects

JEDAI - Event Driven Artificial Intelligence Hardware for Biomedical Sensors

AIR - Analogue Intelligent chip for short and middle range Radar signal processing

SMALL - Spiking Memristive Architectures for Learning to Learn

APROVIS3D - Analog PROcessing of bioinspired Vision Sensors for 3D reconstruction

UNICO - Unsupervised spiking neural networks with analog memristive devices for edge computing

Major Achievements and Outputs

- ❖ **Major outputs**
  - ✓ **Algorithms for training spiking networks**
  - ✓ **Analog HW-friendly algorithms**
  - ✓ **Spiking Chip with learning capabilities**
  - ✓ **New signal processing architectures**
  - ✓ **Creation of new datasets**

Major Achievements and Outputs

- ❖ Areas of impact
  - ✓ Health monitoring (JEDAI, AIR)
  - ✓ Edge AI (SMALL, AIR, JEDAI, UNICO)
  - ✓ Autonomous navigation (APROVIS3D)
  - ✓ Pattern recognition (UNICO, APROVIS3D, JEDAI)
  - ✓ Surveillance (AIR, APROVIS3D)
  - ✓ Robotics (SMALL)

Major Achievements and Outputs

❖ Needs that might be met thanks to the results of our projects
- ✔ Reduced power consumption
- ✔ Near sensor processing with high accuracy
- ✔ Online adapting AI systems

=> new applications - the sky is the limit!

Upcoming Challenges and Needs

- **Long-Term Vision**
  - ✔ Learning in spiking neural networks
  - ✔ Enabling event-based signal processing
  - ✔ Increasing density and robustness of non-volatile memories
  - ✔ Real-life demonstrations of analog computing

- **Research methods and needs**
  - ✔ Complementary expertise of interdisciplinary groups
  - ✔ Focus on cooperation not competition
  - ✔ Long-term ambitious research programs
  - ✔ Industry involvement

Possible Roadmap

- **Prove the concept with physical demonstrators**
- **Focus on specific applications**
- **Technology transfer of the project results to European industrial partners**
  - Demo in trade fairs or conferences
  - Direct contact with identified stakeholders
- **Follow-up projects**

Role of the CHIST-ERA Support

- Selection of interesting topics and guiding national funding agencies
- Opportunity for young researchers to work on ambitious projects
- Facilitating transnational collaborations
- Networking opportunities

++ very limited bureaucracy :-) !
-- coordination CHIST-ERA <-> national agencies to avoid double applications

Responsible Research & Innovation

- **Examples of good practices:**
  - ✔ Open Access publications
  - ✔ Scientific talks (Open Science, Science education)
  - ✔ Sharing datasets in public repositories

- **Major hurdles:**
  - ✔ Double-paying for publishing Open Access
  - ✔ Effort to make data FAIR-compatible
  - ✔ Communication with broader audience to raise the awareness and trust
  - ✔ Adapting the scientific content to a general audience necessitates dedicated resources and competencies

Open Science

- ✔ Open Access publications
- ✔ Scientific talks (Open Science, Science education)
- ✔ Sharing datasets with documentation in public repositories

Templates, examples and recommended tools would facilitate the production of DMP
Recommendation in the call text to account in the budgets for the effort to make data FAIR-compatible

Technology Transfer

- **Negotiating Consortium Agreements among industry and academia partners (different points of view)**
  - ✔ Chist-era specific Consortium Agreement templates missing
- **Reluctance of industry to openly share the know-how, data, and other results - OS vs IPR**
- **The outcomes of challenging research project are seldom ready to be commercialized**
- **Useful to advertise and promote project results towards industry in an early stage**

Questions ?