AI and Signal Processing Techniques for Parkinson’s Finger Tapping Project Cost-Benefit Analysis

Purpose

To evaluate whether the benefits of developing an AI-assisted Parkinson’s finger-tapping assessment tool outweigh its financial, operational, and long-term costs.

Tangible Costs

Cost Category	**Description**	**Estimated Cost**
Labour (FTE-based, 4 members)	6-month effort at 2.4 FTE	**£36,000**
Miscellaneous Expenses	Software licences, storage, printing, materials	**£200**
Contingency Buffer (5%)	Minor unexpected costs	**£1,800**
Total Tangible Cost		**£38,000**

Intangible Costs

Intangible Cost	**Description**
Time investment	6 months of academic effort from team members
Technical risk	Potential model underperformance requiring additional work
Learning curve	Time spent understanding datasets, tools, and clinical background
Reputation risk	Poor results could reflect on the team if not managed

Project Benefits

Tangible Benefits (Financial or Operational)

Benefit	**Description**	**Estimated Value**
Reduced clinician assessment time	Finger tapping is currently assessed manually (≈10 min/patient). Automation could reduce this by 50–70%.	£5,000–£12,000 per year in staff time savings (depending on usage).
Low-cost reusable AI tool	Once developed, the tool can be reused with minimal cost.	£3,000–£5,000 avoided future development cost.

Benefit	Description	Estimated Value
Improved diagnostic accuracy	AI system aims for ≥85% clinical alignment, fewer misclassification errors.	Hard to quantify financially, but significant impact on treatment outcomes.
Enhanced research capacity	University can reuse the model for future academic projects.	£5,000+ saved in future project development time.

Estimated tangible benefit (1–2 years): **£13,000–£22,000**

Intangible Benefits (Non-Financial Value)

Intangible Benefit	Impact
Better patient experience	More accurate and consistent assessments lead to better diagnosis & treatment.
Increased clinician confidence	Objective metrics improve trust in monitoring progression.
Academic prestige	Potential for publications, conference presentations, and improved research output.
Future scalability	Framework could be extended to other motor symptoms (gait, tremor, speech).
Supports digital healthcare innovation	Aligns with NHS digital transformation goals and research trends.

These benefits cannot be quantified financially but are high-value to healthcare, making them extremely persuasive for stakeholders.

4. Return on Investment (ROI)

ROI = (G – C) ÷ C,
where **G** = financial gains and **C** = total costs.

Assumption for ROI:

Use a conservative tangible gain estimate G = £15,000 (within the £13,000–£22,000 range).

Formula:

$$\mathrm{ROI} = \frac{£15{,}000 - £38{,}000}{£38{,}000}$$

$$\mathrm{ROI} = \frac{-£23{,}000}{£38{,}000} = -0.605\ (-60.5\%)$$

Interpretation:

A strict financial-only ROI is **negative**, which is normal in healthcare and academic research projects, because:

- The objective is diagnostic improvement, not financial profit.
- Benefits are long-term, operational, and clinical, not immediate revenue.
- Intangible benefits are the primary drivers (patient care, accuracy, research value).

Cost–Benefit Summary Table

Category	**Costs**	**Benefits**
Tangible	£38,000	£13,000–£22,000 (1–2 years)
Intangible	Learning curve, technical effort	Improved diagnosis, patient monitoring, research output, clinical impact
ROI (Financial)	Not favourable	ROI (Long-term clinical value) = Strong
Conclusion	Costs higher than direct gains	Benefits far outweigh costs in clinical value, academic impact, and long-term scalability

6. Conclusion

Although the strict financial ROI is negative, the non-financial (clinical and strategic) benefits far outweigh the cost, making this project justifiable and valuable.